INDIA
RUBBER WORLD

OUR
62nd YEAR

A BILL BROTHERS PUBLICATION

JUNE 1951

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Built for DEFENSE

TANK BLOCKS

Reinforced with Vulcan-3 AND Spheron-6

CABOT

..Proved BEST, because these CABOT blacks add greatest long-term resistance to terrific, everyday

SCUFFING
POUNDING
SCRAPING
CHIPPING
CUTTING
TEARING

GODFREY L. CABOT, INC.
Boston 10, Mass.

..*Processes well in synthetic rubber, too

You can rely on

Du Pont THERMOFLEX A

for unexcelled flex-cracking protection

If your product needs the best possible flex-cracking protection, you'll take no chances if you use Du Pont Thermoflex A. This antioxidant is time-tested. For over fifteen years it has been the accepted standard of excellence among all flex-resistant antioxidants. This reputation is based on performance. And the results shown in the accompanying data are typical of this performance.

Two natural rubber stocks, one with and one without Thermoflex A, were compared for resistance to flex-cracking. The cured specimens were tested on the Du Pont Flexing Machine according to Method C of the Standard Method of Dynamic Testing for Cracking of Rubber Products (ASTM D 430-40). Degree of cracking is expressed in units from 0 to 10. A sample rates 10 when it cracks completely across the grooves in the sample. Zero rating indicates no cracking. Note that the unprotected stock failed completely in 64 hours. The stock with Thermoflex A, on the other hand, showed only slight evidence of cracking after 136 hours.

TEST RECIPES

Smoked Sheets	100	100
Zinc Oxide	5	5
Channel Black	50	50
Stearic Acid	3	3
Pine Tar	1.5	1.5
Sulfur	3	3
Zenite B	1.25	1.25
Thermoflex A	1	-

(Specimens cured 60 min. at 274° F.)

FLEX RATING

Flexing Time		
64 hrs.	0	10
136 hrs.	2.5	Discontinued at 64 hours

Not only is Thermoflex A outstanding for flex-cracking resistance, but it's also excellent for protection against normal aging deterioration. It provides very good heat resistance, it's extremely easy to disperse and it does not affect cure.

So try Thermoflex A if you aren't already using it. Samples are available. For more information contact your district office or write to the address below.

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Akron, Ohio	40 E. Buchtel Ave.	HEmlock 3161
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DU PONT RUBBER CHEMICALS

E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.

DU PONT

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

INDIA RUBBER WORLD, June, 1951, Vol. 124, No. 3. Published Monthly by BILL BROTHERS PUBLISHING CORP., Office of Publication, Orange, Conn., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U.S.A. Entered as Second Class Matter at the Post Office at Orange, Conn., under the act of March 3, 1879. Subscription United States and Mexico, $3.00 per year; Canada $4.00; All Other Countries $5.00; Single Copies 35 Cents. Address Mail to N. Y. Office.

Another new development using

B. F. Goodrich Chemical Company ***raw materials***

cutting block that cuts costs, too!

"Cut Rite Bloc" made by Rubber Engineering and Chemical Co., Lake Zurich, Ill.

HERE'S another success story that may help you—that shows how Hycar rubber improves products while it cuts costs.

The picture here shows a laminated cutting block made with a Hycar rubber compound. And what a difference it makes, compared to ordinary blocks. With formerly-used blocks, leather, rubber, cloth and other materials are frequently soiled by sawdust or discoloration.

This problem—and others—went by the boards when the Hycar-made block was developed. Cutting noise is greatly reduced. Dies remain sharp longer. There's uniform cutting efficiency in any weather. The block is good for millions of cuts. The wear-down in normal service is approximately ¼" per year.

It's another score in the long list of Hycar-helped successes. For Hycar is so versatile that it resists heat and cold, water, weather and wear, gas, oil, chemicals and more damaging conditions.

Hycar may answer your problems—may help you improve or develop a product. Demand now exceeds supply, but limited quantities are available for experimental work. For helpful technical advice and information, please write Dept. HB-3, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

See Sweet's File for Product Designers, Materials Section, for further data on Hycar

GEON polyvinyl materials

HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

Need extreme temperature resistance? Hycar has it—plus abrasion resistance and more advantages.

Hycar
Reg. U. S. Pat. Off.
American Rubber

If you want to keep your tensile high

Philblack* O *is the guy to buy!*

Hercules! Atlas! Look to your laurels! Strongman Philblack O puts sinewy muscles in rubber compounds.

Yes, this tough, sturdy HAF (High Abrasion Furnace) black imparts remarkable stress-strain properties to V-belts, conveyors and other mechanical goods, along with exceptional abrasion resistance.

When your product needs plenty of stamina, specify Philblack O. Our expert technical representatives will gladly discuss proper compounding procedures and recipes for optimum results in GR-S, low temperature polymers, and natural rubber.

PHILLIPS CHEMICAL COMPANY

PHILBLACK SALES DIVISION

EVANS BUILDING · AKRON 8, OHIO

Phillips 66

Philblack A and Philblack O are manufactured at Borger, Texas.
Warehouses in Akron, Boston, Chicago and Trenton. West Coast agent: Harwick Standard Chemical Company, Los Angeles. Canadian agent: H. L. Blachford, Ltd., Montreal and Toronto.

* A Trademark

NAUGATUCK ANNOUNCES:

a new blowing agent

for Natural or Synthetic Rubbers, Plastics and Plastisols

Celogen

NON-TOXIC — NON-DISCOLORING — NON-STAINING — ODORLESS

Used Alone or as an Auxiliary with Sodium Bicarbonate For Fine Uniform Cell Structure—Open or Cellular

ESPECIALLY RECOMMENDED FOR

- * Continuous cure, fine sheet sponge
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PROCESS • ACCELERATE • PROTECT with NAUGATUCK CHEMICALS

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Yes, you will profit, as have many others, if you write to EEMCO for their proposition on Rubber and Plastics Processing Machinery. Engineered right, built right and of best obtainable materials you are assured of longer life and better production when you select EEMCO. If your present or future needs include any of the machines listed below, write EEMCO for a quotation. You will like their attractive prices and quicker deliveries. Standard and custom made, of course.

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CRACKERS
LABORATORY MILLS
LABORATORY PRESSES

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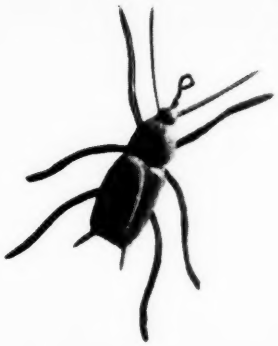
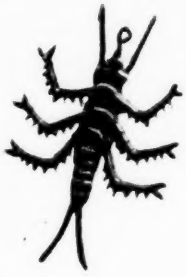
RUBBER AND PLASTIC
MACHINERY DIVISION



EXACT REPRODUCTIONS—*in color, size and appearance—these fishing lures are protected against color change by* WING-STAY S. *Low water extractibility of this antioxidant also led to its selection over other antioxidants.*

for best color retention and antioxidant protection



use *Wing-Stay S*

WHEREVER you want an ideal combination of antioxidant protection with non-staining properties and excellent color retention — in either natural or synthetic rubber compounds — try Goodyear's use-proved WING-STAY S.

This low-cost antioxidant has been widely used in light-colored foam stocks, whitewall tires, light-colored flooring and a long list of other light- and white-colored items. Users of GR-S 26 will find WING-STAY S already added when they purchase this rubber from the Office of Rubber Reserve.

Photos courtesy of the Rubber Development Company, Kent, Ohio

Write for full details and sample for your evaluation to:

GOODYEAR, CHEMICAL DIVISION, AKRON 16, OHIO

USE PROVED *Products*

GOODYEAR

Wing-Stay—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

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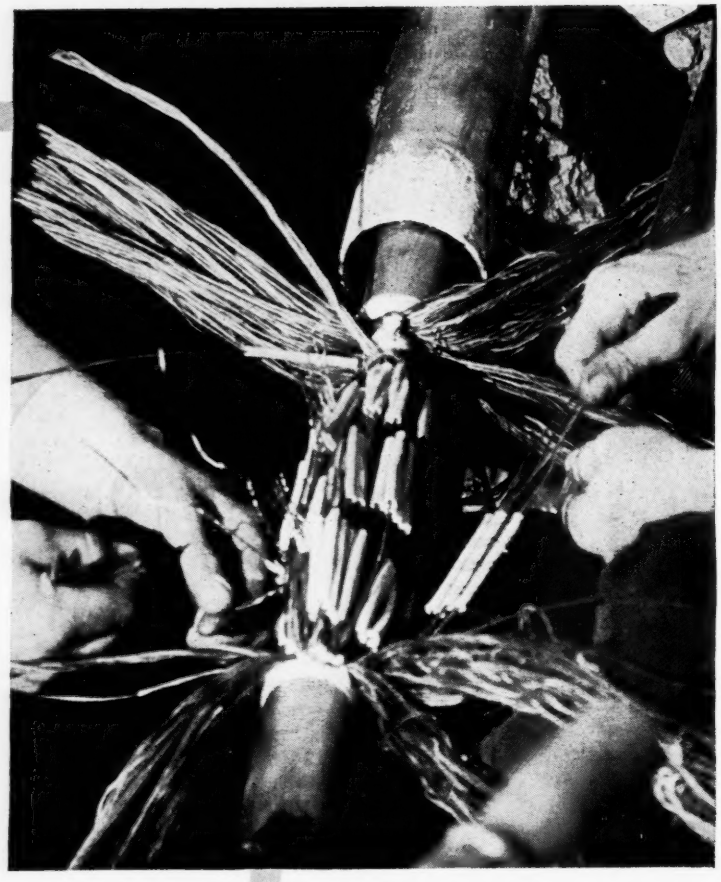
FOR QUICK, LASTING *Identification* ...FULL ELECTRICAL PROTECTION



The ever increasing complexity of electrical and electronic equipment makes fast, accurate, lasting identification of circuits essential.

White and tinted insulations of latex, vinyl or polystyrene are greatly improved through the use of TITANOX pigments. TITANOX-RA, for example, is not only compatible with all the above compounds but imparts exceptional whiteness or increased opacity which yields bright, clear tints. Furthermore, TITANOX pigments, because of their stability and dielectric characteristics, contribute to the electrical value of the insulation.

Our Technical Service Department is always available to help you with your problems in pigmenting all types of natural and synthetic polymers. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; Boston 6; Chicago 3; Cleveland 1; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 9, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Ltd., Montreal 2; Toronto 1.

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RECOMMENDED FOR

Synthetic Rubber

EFFICIENT, ECONOMICAL LOW TEMPERATURE (-80°C) *Plasticizers*

Ricinoleate Esters are fully equivalent and in many instances superior to the commonly used commercial plasticizers employed when low temperature flexibility is required. For flexibility in the range of −80°C, depending on choice of rubber, the following are highly recommended:

Ricinoleate Esters

25% NITRILE RUBBER — PG-16, Butyl Acetyl Polyricinoleate

40% NITRILE RUBBER — P-4, Methyl Acetyl Ricinoleate

NEOPRENE GN — P-6, Butyl Acetyl Ricinoleate

GRS — P-4, Methyl Acetyl Ricinoleate

Samples will be sent promptly on request. Please use the convenient coupon or clip it to your letterhead for quick service.

Baker Castor Oil Company
Dept. RW, 120 Broadway, New York 5, N. Y.
Please send samples of the Ricinoleate Esters checked or Technical Bulletin.

☐ PG-16 ☐ P-4 ☐ P-6
☐ Technical Data

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THE baker CASTOR OIL COMPANY

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ADAMSON UNITED COMPANY

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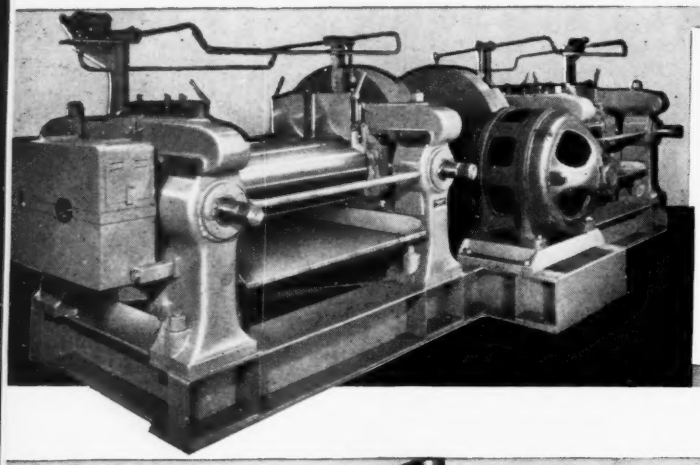
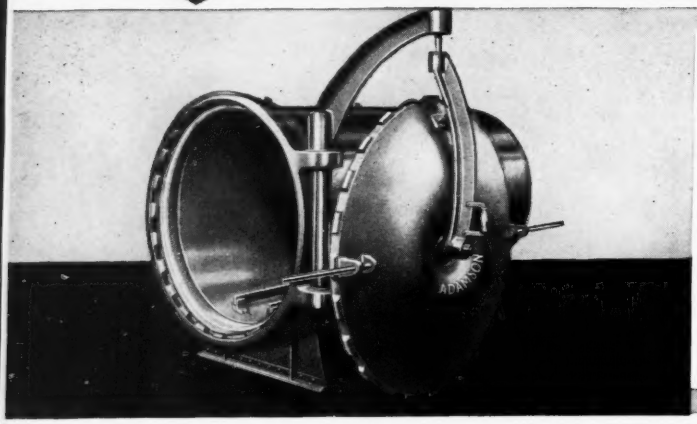
Plastics and R



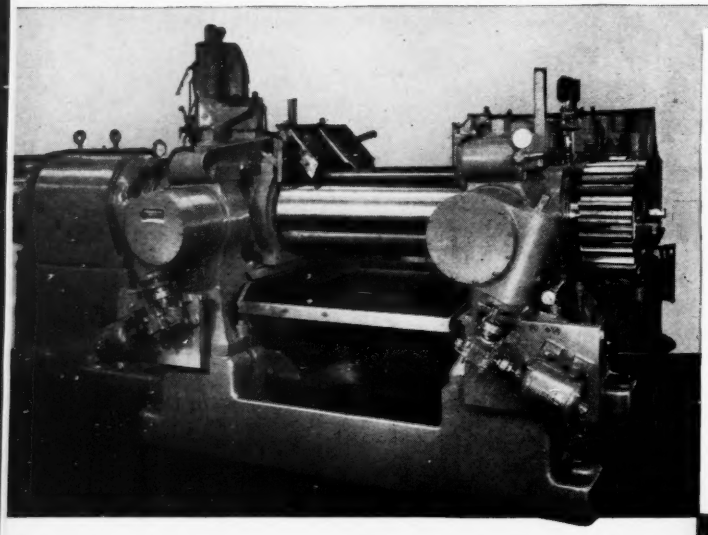
TWIN MILL UNIT

22" & 22" x 60" Mills designed and built for mixing and plasticizing an internationally known plastic material. The rolls operate in anti-friction bearings and the two Mills, together with right angle drive and motor, located between the units, are mounted on a continuous one-piece bedplate.



VULCANIZERS or AUTOCLAVES

Built in sizes ranging from 18 inches to 15 feet in diameter and any length, vertical or horizontal. Illustration shows a horizontal type with hinged, quick-opening door. Vulcanizers can be built to withstand internal pressures up to 1000 pounds per square inch. Write for our special bulletin .



MIXING MILLS

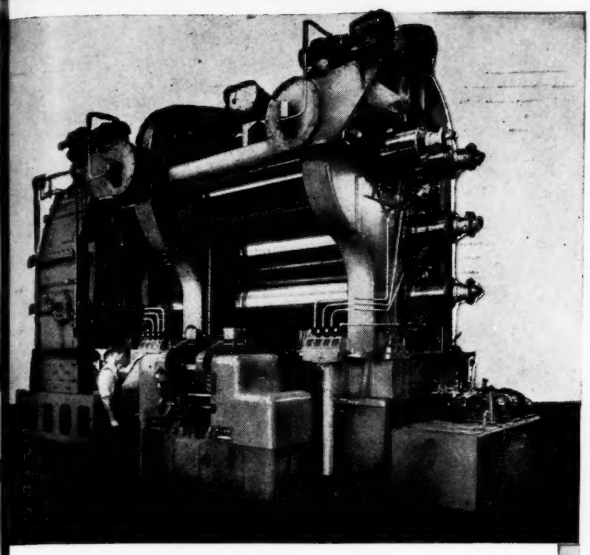
These are built in all sizes from 6" x 16" to 28" x 84". The one illustrated is a late model (shown without gear enclosure), designed for plastics. It has rolls 20" in diameter by 48" long on the working face; flood lubricated roll boxes; tilting stock guides; motor-operated adjusting screws; stainless steel stock pan; dial indicators for front roll position; two sets of connecting gears for operating rolls at two different friction ratios, and an individual motor drive, with geared head and flexible coupling direct-connected to rear roll.

We can supply any size Mill driven individually; in pairs with right angle reducer between the units; or grouped on a line shaft with reducer at one end of the shaft.

Write for our new catalog covering Mills, Refiners, Crackers and Washers.

Designers and Builders of Basic Machinery for the Rubber, Plastics and Plywood Industries

d Rubber Processing Machinery



CALENDERS

The large Calender has four rolls measuring 36" in diameter by 92" long on their working faces. They are mounted in anti-friction bearings which are preset for precision operation at high temperature. Each roll is individually-driven from a separate gear stand. All bearings are flood lubricated from a central supply. The off-set, top and bottom rolls have individual motorized adjustment through double Cone worm reducers.

The small Calender in the foreground has four rolls measuring 8" in diameter by 16" long on their working faces. These rolls also operate in selected anti-friction bearings which are flood lubricated.

Each Calender is provided with motor and electric controls installed on flush mounted panels.

In addition to designing and building Calenders, we can supply all the processing equipment necessary for a complete operation. This includes plastic sheeting and the coating of fabrics with plastic or rubber compounds.

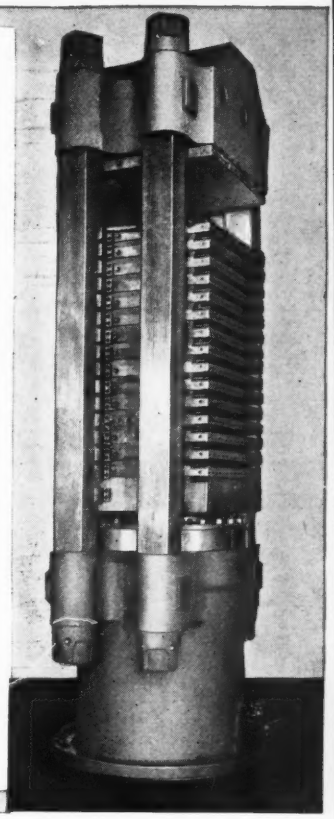
Write for our new calender catalog.

MULTIPLE DECK PRESSES

Multiple deck press with fifteen openings. This Press was constructed for extremely high pressures per square inch on the platens. We have standard designs for square platen presses in sizes varying from 12" x 12" to 60" x 60", and for Presses with oblong platens ranging from 12" x 14" to 70" x 84". Patterns and drawings are available for almost any size within the above two ranges but we are prepared to design and construct much larger ones.

These Presses can be built self-contained or for connection to existing hydraulic supply.

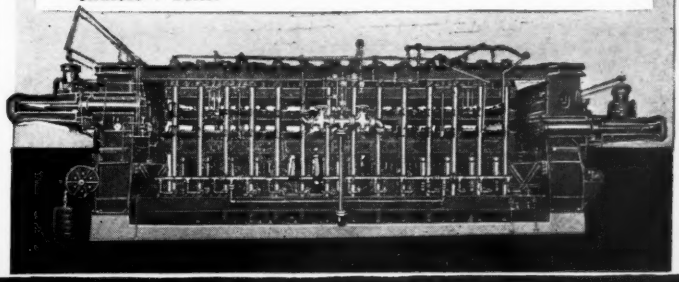
Write for our new catalog covering our full line of Hydraulic Presses.



BELT PRESSES

Belt Press with two openings. Platens are 63" wide by 31' long. This Press weighs over 300 tons and will deliver 250 lbs. per square inch on the platens. It comes complete with stretchers and clamps, the latter mechanically controlled directly from the movement of the platens. Standard designs for various sizes are available.

In addition to the above we also make a full line of open side Presses equipped with stretchers and clamps to cure endless V-belts.



ADAMSON UNITED PRODUCTS

- Mills
- Refiners
- Crackers
- Washers
- Rubber Sheeting & Coating Calenders
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- Calender Cooling Rolls
- Complete Calender Accessory Equipment
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- Pot Heaters
- Vulcanizers
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- Rotocure Machines
- Hydraulic Presses
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- Automatic Curing Presses
- Belt Curing Presses
- Compression Molding Presses
- Plywood Presses
- Auxiliary Equipment

ADAMSON UNITED COMPANY

AKRON, OHIO

Plants at Akron, Uhrichsville, Barberton, Uniontown, Cuyahoga Falls, Hudson, Hardgrift, New Castle, Youngstown, Canton

ACTIVATOR NEWS

HORSE HEAD PRODUCTS

A supplement to THE ACTIVATOR—the house organ issued by The New Jersey Zinc Company for over 15 years to aid the Rubber Industry in its use of Zinc Oxide.

A CUSTOMER TELLS US— "PROTOX ZINC OXIDE CUTS POWER COSTS"

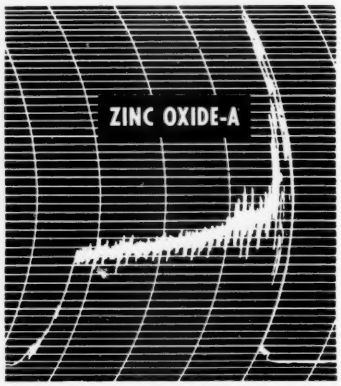
This customer explains that, by simply replacing conventional zinc oxide with Protox-166* in zinc masterbatching, he dropped Banbury power costs in these *2 ways:*

1. Total power use per batch is noticeably lower.
2. Power peaks are eliminated – thus reducing premium payments for excess plant loads.

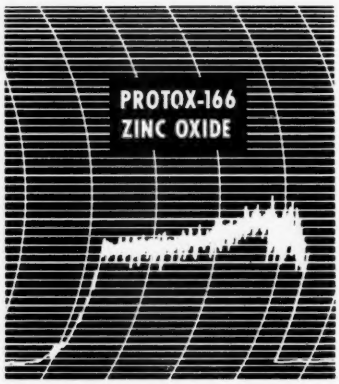
He found, too, that Protox-166 dispersed more completely and imparted faster, smoother tubing and calendering.

The accompanying power consumption charts of masterbatches made on our laboratory Banbury confirm this customer's results.

** U. S. Patents 2,303,329 and 2,303,330.*



Conventional zinc oxide requires high power consumption at the start of masterbatching (at right) when rubber is replacing gases adsorbed on the pigment surface.



Protox-166 zinc oxide cuts power costs because its zinc propionate coating provides easy wetting by rubber, improved dispersion, and better tubing and calendering.

THE NEW JERSEY ZINC COMPANY

Producers of Horse Head Zinc Pigments
. . . most used by rubber manufacturers since 1852

160 Front Street, New York 38, New York

HORSE HEAD PRODUCTS

strengthen your synthetic with Purecal

You can get close to natural rubber quality in GR-S when you reinforce it with Purecal*, producing a non-black base. Here is the quality produced with a 150-part loading of Purecal U in a GR-S containing 20 parts of a medium hard cumarone indene resin:

Tensile strength—over 2000 pounds per square inch; elongation—over 700%; tear resistance (Crescent)—200 pounds; flex-life (pierced)—over 200,000.

These results are fairly common with Purecal U. In addition, Purecal U can be used to impart "building tack" to GR-S and Buna N compounds. It produces a base stock with carbon black quality which can be used *everywhere* that low gravity and high abrasion resistance are not a factor.

It will pay you to get acquainted with Purecal. Why not write for our free booklet?

**Trade-mark*

SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA
CALCIUM CARBONATE • CALCIUM CHLORIDE • CHLORINE
HYDROGEN • DRY ICE • SYNTHETIC DETERGENTS • GLYCOLS
CARBOSE (Sodium CMC) • ETHYLENE DICHLORIDE • PROPYLENE
DICHLORIDE • AROMATIC SULFONIC ACID DERIVATIVES
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Wyandotte, Michigan • *Offices in Principal Cities*

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RUBBER & PLASTICS MACHINERY BULLETIN

Reporting News and Machine Design Developments

IN BUSINESS TO NRM REDUCE YOUR COSTS

Extruder Specifications Available

Specification bulletins on all sizes of NRM Rubber Extruders, 2½" through 12", are now available.

For copies of bulletins, specify sizes of extruders in which you are interested, and write Rubber Machinery Division, National Rubber Machinery Company, Akron 8, O.

Specifications cover Extruder construction, screw speeds, recommended motor drive, and include piping and floor plan drawings.

New MIL-X-TRUDER eliminates warm-up mill

A new development from the NRM laboratories permits recirculation of stock in the Mil-X-Truder, eliminating the additional milling formerly done on the warm-up mill. Elimination of the warm-up mill and labor for its operation, and reduction of maintenance and floor space requirements will materially reduce extrusion costs.

Stock can be fed to the Mil-X-Truder in the form of pelletized stock, stripped direct from the roll-out mill, or strip-fed at room temperature, with equally satisfactory results.

Many materials difficult to extrude such as Silastic compounds can now be fed hot or cold to a Mil-X-Truder. Commercial accuracy can be maintained on sticky materials and asbestos loaded materials. Neoprene, Buna and Butyl are brought into the class of standard extrusions by this equipment.

SZEGVARI ATTRITOR REDUCES COSTS; HAS REVOLUTIONIZED GRINDING PROCESSES

The Szegvari Attritor was developed by pioneers in latex processing. This new fine grinding machine makes conventional equipment obsolete—both by production and mechanical operation standards. Unlike conventional grinders, the Attritor has a stationary grinding tank instead of bulky rotating cylinders. Grinding elements and charge are intimately mixed together and exposed to controlled agitation by an especially designed agitator.

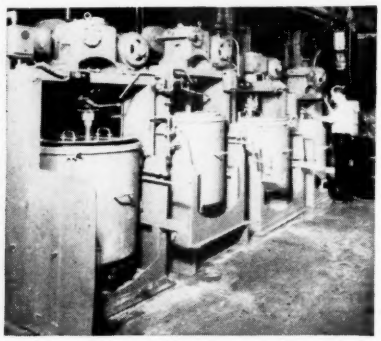


Photo: Courtesy American Anode, Inc.

Szegvari Attritors are built by NRM for the Union Process Co., Akron, Ohio—Specialists in grinding equipment. This battery of four Attritors has been in operation over a period of years grinding almost all ingredients used in rubber processing—including vulcanizing agents, color pigments, etc.

The Szegvari Attritor is small, but output is large. An Attritor requiring floor space of only 55" x 77" can produce as much as 20 times faster, with finer size, than conventional grinders. No elaborate mountings or foundations are necessary.

Greater safety in grinding hazardous material is another Attritor "plus". Reason: The volume of active grind in the Attritor is small and there is *no mechanical action in the air space* above the grind. Also a jacketed tank gives accurate temperature control. Rapid charging and discharging of the Attritor is achieved by a built-in pumping system.

MANPOWER SAVED WITH AUTOMATIC BIAS CUTTER CONTROLS

No operator needed in band-building set-ups for different ply widths

With the use of NRM's fully automatic bias cutter controls, no operator is needed in band-building set-ups, which require cutting one width for a period of time, then changing to another width for a similar period.

Manual operation can be used where desired for abnormal conditions, and service personnel can check the cutter occasionally. However, the cutter will operate as long as the cut stock is being removed from the bias cutter table. An auxiliary device accurately positions the stock in line with the splicing take-off for maximum splicing efficiency.

Ply widths are gaged and controlled directly by two photo-electric cells, mounted on the cutter bar. The width being cut is indicated on a large, easily read scale. Handwheel adjustment of ply width can be made from either side of the cutter.

A control station mounted on the side of the cutter provides for complete control of all electrical equipment: cutter motor, and let-off motor. A main control panel houses the control elements.

The table is driven by a special motor.

CUTTING SPEEDS

Range of ply widths	Max. cuts per minute
10" to 24"	20
24" to 36"	18
36" to 48"	15

The handwheel normally used for final determination of width is equipped with a clutch to permit disengaging the handwheel for automatic operation.

Your present cutters can be converted for fully automatic operation by the addition of NRM's electronic equipment, a knurled table drive roll with integral drive sprockets, a self-leveling high festoon, and separating rolls to open a space between plies for photocell operation.

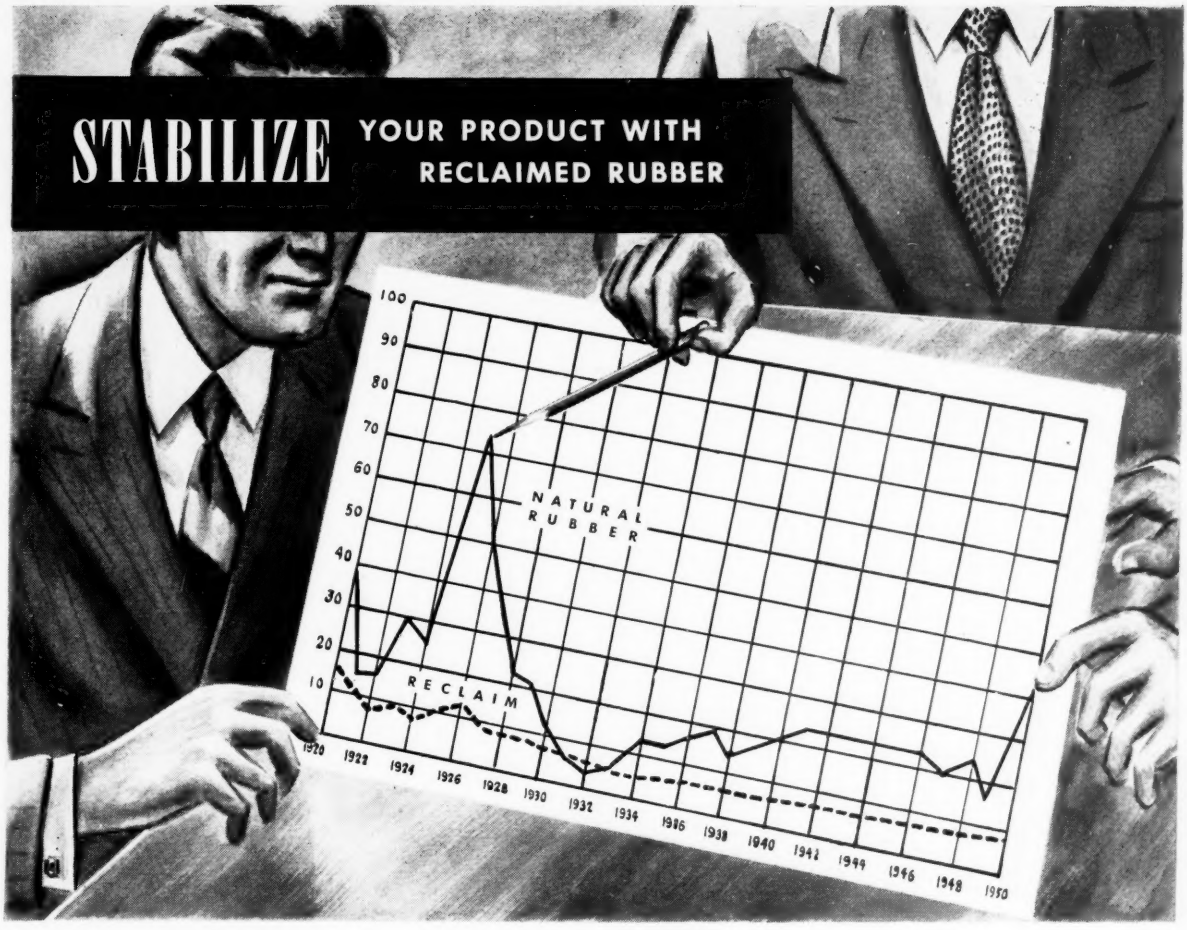
Angles from 45° to 90°, and ply widths from 10" to 48" are permitted with the standard arrangement. Greater widths can be accommodated with less angle adjustment.

NATIONAL RUBBER MACHINERY CO.

General Offices & Engineering Laboratories
Akron 8, Ohio

PLANTS at Akron and Columbiana, Ohio and Clifton, N. J.
AGENTS East: National Rubber Machinery Co., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Calif.
EUROPE Rubber Machinery: GILLESPIE & COMPANY
96 Wall Street, New York 5, N. Y.

Creative Engineering



U.S. RECLAIMS help industry *Economize*

. . . without sacrifice of quality!

See that chart above? That's the graphic picture of natural rubber prices as opposed to reclaimed rubber prices over the past 30 years!

The ups and downs of that natural rubber graph have spelled a lot of headaches and heartaches for manufacturers for more than a quarter of a century . . . and, these manufacturers could have minimized their troubles by using a substantial percentage of reclaimed rubber in their formulae. You can always depend on reclaimed rubber . . . in performance AND in price. In price, it has *practically* maintained its status quo during that period and, in performance, reclaimed rubber has *consistently* maintained its high standards of quality and uniformity.

Today, reclaimed rubber will give you FASTER mixing, EASIER processing and STABILIZED quality, production and costs! Whatever you make out of rubber, there is very probably a U. S. RECLAIM that will, wartime or peacetime, help you STABILIZE your production picture and MAKE YOUR NEW RUBBER GO FARTHER.

Always keep reclaims in your formula and always look to U. S. for the best. U. S. Rubber Reclaiming Company, Inc., P. O. Box 365, Buffalo 5, N. Y. Trenton agent: H. M. Royal, Inc., 689 Pennington Ave., Trenton, N. J.

U.S.

68 years serving the industry solely as reclaimers

U.S. RUBBER RECLAIMING COMPANY, INC.

8 DOCUMENTED PRODUCTS YOU SHOULD KNOW ABOUT

Burgess products are not put on the market until they have been given exhaustive laboratory and practical production tests by disinterested concerns of national reputation.

We will gladly send you technical data and samples upon request.

BURGESS "ICEBERG" PIGMENT

(U. S. Pat. 2307239)—white anhydrous pigment with G. E. Brightness of 90-92. Particularly suited for natural rubber and GR-S compounding where good processing and freedom from die plating is important. Excellent for red butyl inner tube and butyl insulation stocks because of good processing, reinforcing, and electrical characteristics.

BURGESS PIGMENT NO. 30

(U. S. Pat. 2307239)—an anhydrous kaolin-type clay for compounding vinyl insulating compounds. Reinforcing agent and filler in synthetic rubber compounds. Yields excellent processing characteristics and high insulation resistance values in vinyl electrical compounds.

BURGESS PIGMENT NO. 20

—a fine particle size water-washed kaolin-type pigment for use in natural and synthetic rubber compounds. Excellent reinforcing agent yielding level cures because of controlled neutral pH.

BURGESS POLYCLAY

—an extremely fine water-washed clay for GR-S compounds. Yields high modulus and ultimate elongation, markedly decreased set-values, lower mill shrinkage, and appreciable reduction in time required to incorporate fillers.

BURGESS ANTISUN WAX

—prevents sun checking of natural and synthetic rubber compounds.

MORFLEX NO. 100

—new Octyl Phthalate-type plasticizer characterized by extreme stability, excellent heat aging resistance, low migration, retention of light transmission and superior electrical quality. (Manufactured by Morton-Withers Chemical Co., Greensboro, N. C.)

BURGESS RECLAIMING OILS

—for acid and caustic reclaiming of synthetic and natural rubber stocks.

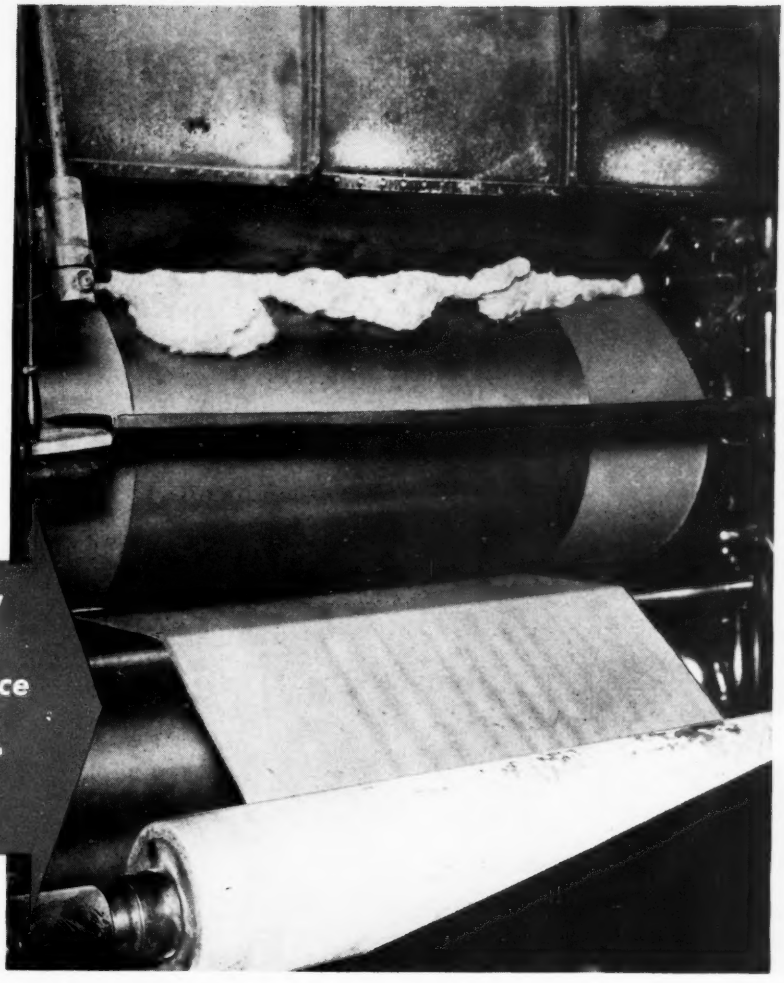
BURGESS S-3 PROCESSING OIL

The use of this excellent processing oil in GR-S compounds permits improved dispersion of carbon black in the Banbury, eliminating the use of stearic acid. S-3 also promotes smoother and faster extrusions.

Burgess Pigment COMPANY

HYDROUS AND ANHYDROUS KAOLIN PIGMENTS · CLAYS · ANTISUN WAX · PLASTICIZERS · WHITINGS · MINERAL COLORS.

EXECUTIVE SALES OFFICES: 64 HAMILTON ST., PATERSON, N. J. • CHICAGO AREA: WALTER H. HERRS, 40 CUSTER ST., LEMONT, ILL. • WEST COAST: MERIT WESTERN COMPANY, 1248 WHOLESALE ST., LOS ANGELES 21, CAL. • MINES AND PLANTS AT SANDERSVILLE, GEORGIA • WAREHOUSES: TRENTON, NEW JERSEY; AKRON, OHIO; PROVIDENCE, RHODE ISLAND.



UNIFORMITY
Makes the Big Difference in **INDUSTRIAL** *Fabrics*

MT. VERNON FABRICS

Give You Greater Fabric Uniformity

The greater uniformity of Mt. Vernon fabrics means *consistent* quality in your finished products—smoother, more efficient fabrication.

AT YOUR SERVICE—Mt. Vernon-Woodberry's staff of textile engineers is available on request to help you with your problems in development or application of industrial fabrics.

Mt. Vernon-Woodberry Mills

TURNER HALSEY
COMPANY
Selling Agents
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• • • **GAUGING FABRIC THICKNESS AFTER WEAVING.** One of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products.

SUBLAC

non-scorching RESIN

a synonym for saving

SUBLAC Resin B-2-A, a white powder, is the lowest priced, non-scorching reinforcing resin available today!

SUBLAC Resin is outstanding in its ability to impart desirable characteristics to rubber compounds. For example, it may be used to obtain any of these properties: Hardness, Stiffness, Abrasion Resistance, Tear Resistance, Oil Resistance. In many cases, the use of **SUBLAC** Resin alone is sufficient to obtain a combination of several of these properties and at the same time provide a compound with easy processing characteristics and a high general order of physicals. *In addition,* **SUBLAC** Resin is *non-scorching!*

SUBLAC Resin B-2-A is especially advantageous in stocks highly loaded with clay, whiting, or Silene. The following compounds are representative of such highly loaded, easy processing stocks that require no 'trick' mixing techniques:

Experimental Slab Stock		Experimental Tile Stock	
GR-S 521	100	GR-S 521	100
SUBLAC Resin B-2-A	30	SUBLAC Resin B-2-A	30
Circo Light	35	Circo Light	15
ZnO	5	ZnO	5
DPG	.15	DPG	.5
Altax	2.13	Altax	2.13
Hard Clay	300	Hard Clay	200
Sulfur	3.70	Whiting	150
		Sulfur	8
	Cure 10′ @ 320° F.		
Tensile	950		
Elongation	450%		
Shore Hardness (A Scale)	97-98	Shore Hardness (D Scale)	60-61

In these compounds, the **SUBLAC** Resin was added to the rubber, then enough clay to take up all of the oil, followed by the remainder of the ingredients in the usual manner.

SUBLAC Resin B-2-A is readily available. ***Send for your sample today!***

Prices | 29½c lb. in truck loads
30c lb. in lesser quantities
fob factory in fiber drums

THE POLYMEL CORP.

1800 Bayard Street
Baltimore 30, Maryland
Phone: PLaza 1240

Better Ride the Tide

Ever wonder why the rubber compounding tide is running so strongly to Naugatuck? That's because hundreds of companies are finding there's nothing quite like the product quality or the research and technical help they get from Naugatuck.

A few of the raft of Naugatuck-processed products are pictured here: Tape, rug underlay and backing, stationery, leather folders, shoe parts, woolens, cottons, conveyor belts, gloves, tire cords, rubber toys. *We cover the waterfront on water-based latices.* For new product improvement or compounds, write to address below.

Lotol® Compounded Latices—Ready to Use.

Kralac® Plastic Latices.

Nitrex® Butadiene Acrylonitrile Copolymer Latex.

Shrink-Master Process for Rendering Woolens Shrink Resistant and Long Wearing.

Latex Natural and Synthetic.

Kandar® Permanent Finish for Textiles.

Koloc® Cationic Resin Compositions for Cotton, Rayon and Wool.

Naugatex® Dispersed Chemical Compounding Ingredients for all Latices.

Kralastic® Flexible Plastic Latices.

Dispersite® Aqueous Dispersion of Rubber, Reclaimed Rubber or Resins.

Naugatuck Chemical **Division of UNITED STATES RUBBER COMPANY**

107 ELM ST., NAUGATUCK, CONNECTICUT

BRANCHES: Akron • Boston • Charlotte • Chicago • Los Angeles • New York • Philadelphia

Rubber Chemicals • Aromatics • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices

Chemicals you live by

IMPROVE YOUR...

LAMINATES

with DIAMOND PRECIPITATED CALCIUM CARBONATES

Laminators and molders find that smoother surfaces, elimination of cracks and of evidence of glass fibres result when DIAMOND Precipitated Calcium Carbonates are mixed with catalyzed, glass-reinforced polyester resins. This is due, in part, to the more even rate of cooling induced by the carbonate filler.

Other advantages in using DIAMOND Precipitated Calcium Carbonates are improved wet strength of the polyester resin, reduced shrinkage and, of course, *lower raw material cost.*

DIAMOND ALKALI offers several grades of Precipitated Calcium Carbonates, each chemically produced under carefully controlled conditions to assure day-to-day uniformity of particle size and purity.

Specifically recommended for reinforced polyester resins are:

SURFEX* — **coated with 1% resin; particle size about 10 microns.**

SUSPENSO* — **same as SURFEX except uncoated.**

KALITE* — **coated with 1% stearic acid; particle size about 1 micron.**

MULTIFEX* MM — **uncoated, particle size about 0.06 micron.**

For further information write for DIAMOND's Bulletin "The Use of Precipitated Calcium Carbonates in Polyester Resins". Our Technical Service Staff is also available to assist you on formulating problems. *®

DIAMOND SALES OFFICES; New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis and Houston. Also representatives in other principal cities.

DIAMOND CHEMICALS FOR PLASTICS COMPOUNDING

DIAMOND ALKALI COMPANY...CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS

When it's PELLETEX you KNOW...

Bead Stock is on for Tire Life

PELLETEX®

Yes, sir, with PELLETEX in the compound, the bead wears better and lasts as long as the tire itself. Processing is easier, extruding uninterrupted, and bead compounds far more effective. High loadings are possible at low volume cost, as well as accelerator savings — which only proves that there's a BEST BLACK for every job, and for bead stocks, PELLETEX is IT!

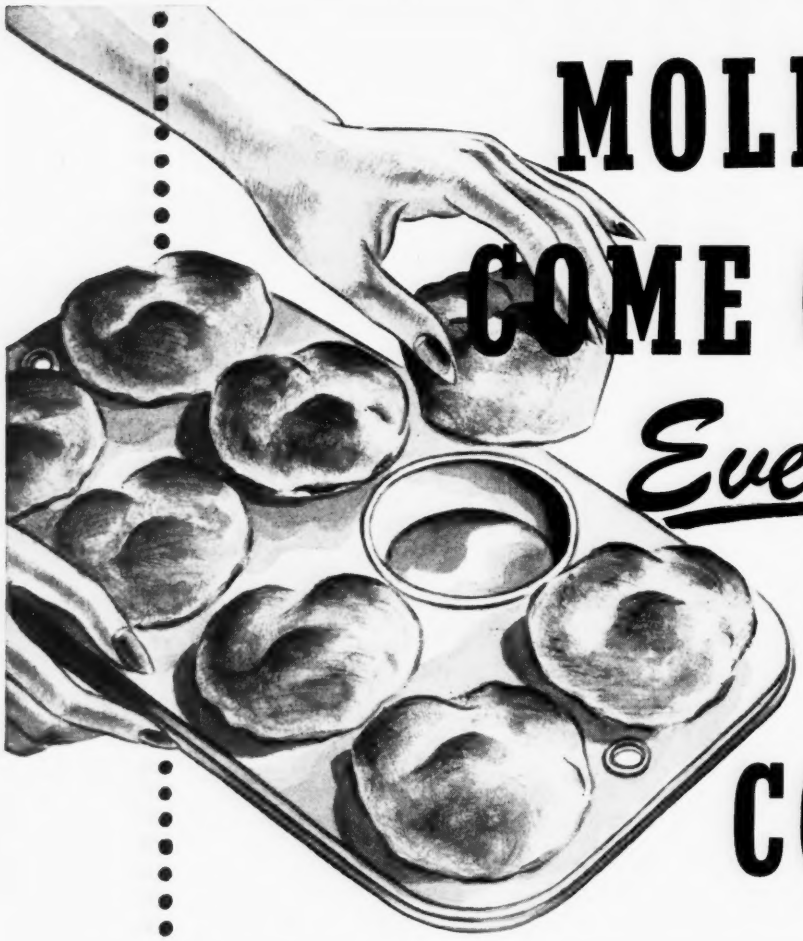
PELLETEX high resilience, good abrasion resistance, and splendid aging properties make it first choice among bead stock manufacturers all over the world. Compounders demand it, because it's grit-free — gives uniform processing every time. Tire manufacturers depend on PELLETEX bead compounds to prevent tire stretching, to simplify mounting, to hold the tire securely to the wheel-rim and to give the outstanding service motorists need and want.

The GENERAL ATLAS Carbon Co.

CABOT

77 FRANKLIN STREET, BOSTON 10, MASS.

Herron Bros. & Meyer Inc., New York and Akron • Herron & Meyer of Chicago, Chicago
Raw Materials Company, Boston • H. N. Richards Company, Trenton
The B. E. Dougherty Company, Los Angeles and San Francisco • Delacour-Gorrie Limited, Toronto



MOLDS COME CLEAN *Everytime* WITH COLITE!

Just as a housewife butters a muffin tin, you can use Colite on any kind of a rubber mold. And you'll find using this highly-concentrated liquid mold-release, as a spray or sponge, pays off with substantial savings!

You can count on jobs coming out with uniform precision — with no pinching, dragging, trimming or spoilage to contend with — and with a transparent, smooth, satiny finish that insures added sales-appeal.

Non-toxic, non-tacky, odorless Colite, developed especially for the rubber industry, comes in a highly-concentrated form, which you dilute with water to the most effective strength for the stock and job at hand — making it economical to use! Send for a sample to test in your plant, now!

Use as a spray or sponge on

Tire molds
General molds
Recapping molds
Inner-tube molds

★

Use as a lubricant for

Tires or Mandrels

★

For light colored stock

SPECIFY COLITE D43D

BEACON
PURITY · UNIFORMITY · DEPENDABILITY
Chemical Industries, Inc.
BOSTON 30, MASSACHUSETTS

HERE IS
ONE REASON . . .
The body of a chilled iron roll is formed by pouring molten metal into an iron mold or chill. Iron being a good conductor of heat, cooling is rapid, causing the surface of the roll body to "chill" and harden. The body of the roll below the chilled surface cools slowly, forming a gray iron structure which gives strength to the roll. Sand molds are used for the necks, and, since sand is a poor conductor of heat, the metal becomes a gray iron composition with physical properties which make the necks strong, yet readily machinable.
HOPPER FOR POURING
RUNNER
ROLL
FLASK
FLOOR LEVEL
CHILL
CASTING PIT
CHILL
FLASK
GATE
SAND

why Farrel-Birmingham Rolls *last so long*

The depth of the white iron "skin" or chill is one of the principal factors affecting the service life of a chilled iron roll.

In every Farrel-Birmingham roll the thickness of chill and gray iron body are combined in correct proportion to provide *maximum service.* The chilled section is sufficiently deep to resist crushing and abrasion, and the gray iron structure of the body beneath gives adequate strength to carry the load imposed on the roll in the service for which it was designed.

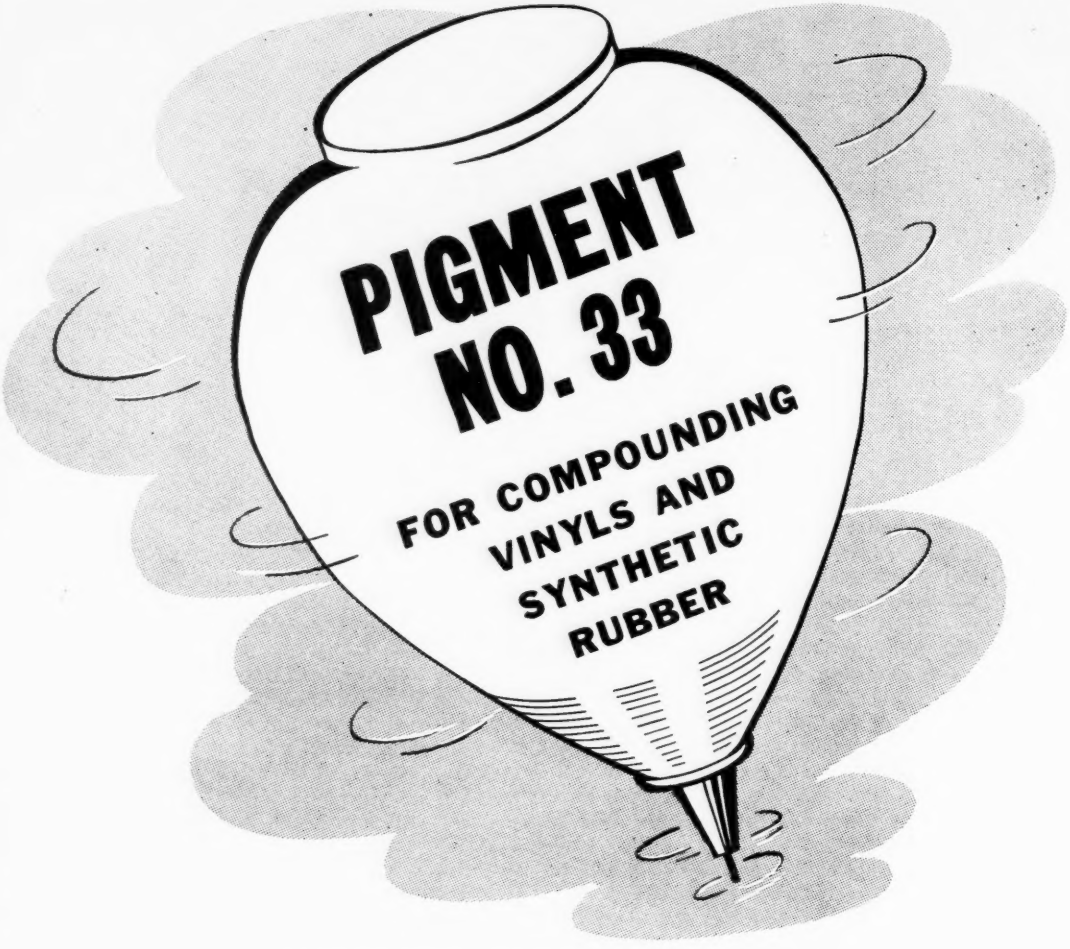
Experience in building a wide variety of roll-equipped processing machines guides company engineers in determining the proper depth of chill. Then the rolls are cast so true and with such accurate contours that they require a minimum of turning and grinding to finish to size. This casting accuracy is responsible for the full, uniform depth of hard chilled surface being retained nearly as cast.

Proper depth of chill is only one of the reasons why it pays to order your roll renewals from the *world's largest specialty roll shop.* Write for information about rolls for specific applications.

FARREL-BIRMINGHAM COMPANY, INC. • ANSONIA, CONN.
Plants: Ansonia and Derby, Conn., Buffalo, N. Y. *Sales Offices:* Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

Farrel-Birmingham®

IT'S "TOPS"

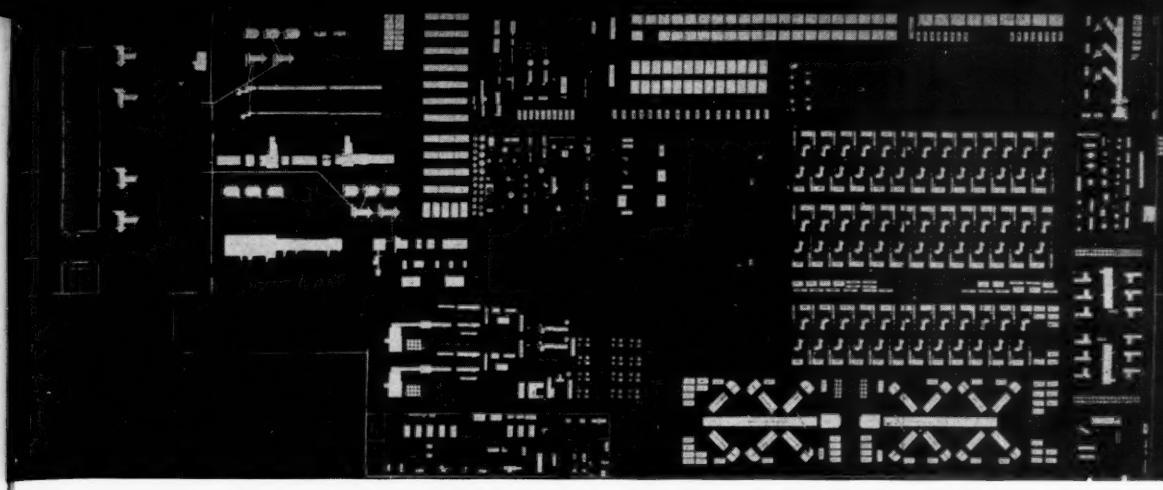


• SUPERIOR ELECTRICAL TESTS
• HEAT STABILITY
• COLOR

Sample and technical data sent promptly on request

SOUTHERN CLAYS, Inc.

33 RECTOR STREET
NEW YORK 6, N. Y.



Layout for Tire Plant Now Producing 2,000 Tires Per Day

Complete Engineering Service

The engineering group at GIFFELS & VALLET, INC., numbering some 150, has played an important part in developing the rubber and plastics fabrication facilities of this country during the last two decades. They know the practices and methods which will economically accomplish the production. They know the equipment; its performance, and maintenance characteristics, which reduce manual labor and help to make possible good working conditions.

They furnish any or all of the following services for projects of any size:

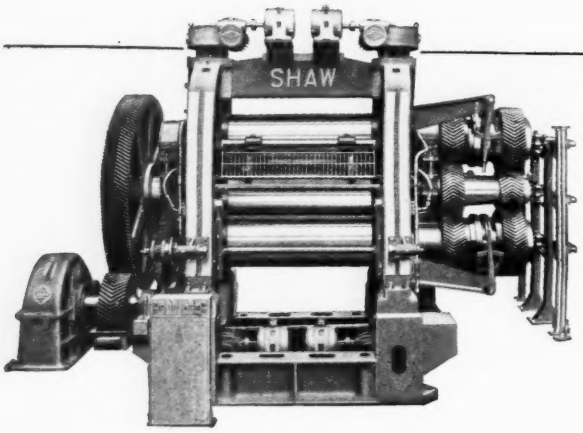
- Operation Analysis
- Equipment Selection
- Plant Layout
- Cost Estimates
- Specification for Equipment
- Purchase Recommendations
- Building Design
- Power and Lighting
- Dust and Fume Control
- Process Piping Design
- Purchasing Assistance
- Expediting Equipment Deliveries
- Construction Supervision
- Assistance in Initial Operation

GIFFELS & VALLET, INC.

INDUSTRIAL ENGINEERING DIVISION

1000 MARQUETTE BUILDING, DETROIT, MICH.

KEEP IN STEP WITH THE TIMES



SHAW

In an industry as progressive as that of rubber manufacture, the engineer is constantly asked to accomplish the unknown, if not the 'impossible'. That is where SHAW experience of the whole field of rubber and plastics machinery comes in —with so many steps behind us, the next forward step comes readily to our enterprise.

A Three-roll Calender with four-motor individually power operated roll adjusting gear, push button controlled, hydraulic jacks fitted to maintain constant pressure on top roll bearings and adjusting gear.

Flood lubrication to roll bearings for high temperature work and reduction of maintenance.

FRANCIS SHAW & COMPANY LIMITED • MANCHESTER II • ENGLAND

R. 199

MILLIONS

...of miniature factories...

United channel blacks are remarkable products wrested from hydrocarbon gases in miniature flames that are starved for air.

United channel blacks stem from over four million precisely regimented flame factories where each particle of black is refined in incandescent heat.

United channel blacks are collected by impingement in the nascent state and they retain their innate activity in support of high reinforcement of rubber.

United channel blacks have been in use for decades and have an enviable record of satisfactory performance. They are uniform, dependable, and ever in demand.

Think of channel black—United channel black—for durable rubber products.

UNITED CARBON COMPANY, INC.
CHARLESTON 27, WEST VIRGINIA
NEW YORK · AKRON · CHICAGO · BOSTON

QUALITY CHECKED
CARBON BLACKS
KOSMOBILE 77 (EPC)
KOSMOBILE HM (MPC)

UNITED CHANNEL BLACKS
bags are printed with your pigment number

UNITED CHANNEL BLACKS
conform to your specifications

UNITED CHANNEL BLACKS
handle exceptionally well

UNITED CHANNEL BLACKS
are of uniform quality

UNITED CHANNEL BLACKS
are always dependable

UNITED CHANNEL BLACKS
are the standard for quality the world over

RESEARCH DIVISION — UNITED CARBON COMPANY — CHARLESTON 27, W. VA.

PARA-FLUX

® REGISTERED TRADE MARK

QUALITY IS ALWAYS THE SAME

BY THE TANK CAR
OR BY THE DRUM

For 27 years PARA FLUX has been the Standard of the Rubber Industry, its quality is always the same whether you are a drum or tank car user.

The C.P. Hall Co.
CHEMICAL MANUFACTURERS

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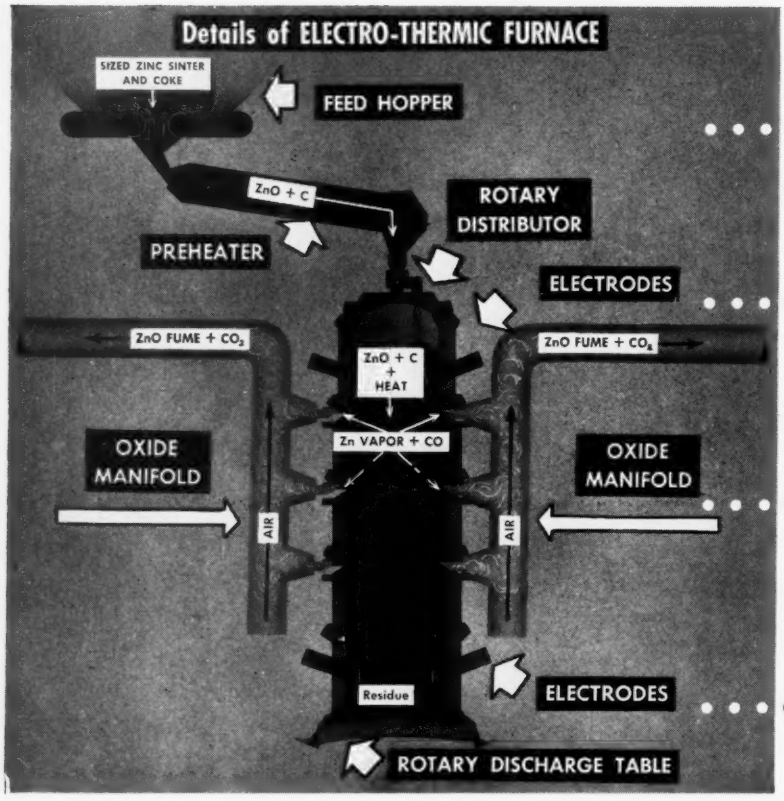
A Precision Instrument



four stories HIGH!

St. Joe lead-free Zinc Oxides in commercial quantities came on the market in February 1931. In the course of these 20 years, and as a result of an expansion program completed in 1950, this company's production of ZnO was increased twelve-fold to meet a corresponding increase in consumer demand. A high percentage of the additional tonnages of St. Joe Zinc Oxides thus produced are now being shipped to old-established consumers – but new to this company – who placed their initial orders at a time when zinc oxide in general was readily available.

Quality of product plus the reliability of this company is, of course, the answer. And the high quality of St. Joe ZnO is largely achieved through the medium of unique precision instruments, the largest of their type in the world: Electrothermic furnaces – the latest improvement in the smelting of zinc oxide by the American Process. This St. Joe Process produces a minimum of gases of incomplete combustion and thus makes possible closer control of the uniformity of zinc oxide where it is most important – at the point of oxidation. This control applies to both chemical composition and particle size. To produce the particle size pigments which require greater dilution of the vapor, the required volume of gases or air is supplied from an auxiliary source. By selection of operating conditions, it is possible by this method to impart characteristics to the finished product which are associated with both the French and other American Processes.

ST. JOE ZINC OXIDE *from the standpoint of* SUPPLY *and* DEMAND

The continuing, unprecedented heavy demand is far greater than our capacity to produce. Hence, to equitably serve all of our regular customers, we are currently shipping to them monthly allocations based on the tonnages purchased during the first ten months of 1950. The only new customers receiving shipments are Government agencies.

ST. JOSEPH LEAD COMPANY
250 PARK AVE., N. Y. 17 • Eldorado 5-3200
Plant & Laboratory, Monaca (Josephtown) Pa.

The design and manufacture of processing rolls has been a highly specialized division of our business for more than 30 years.

Close co-operation with industry has given us an intimate knowledge of production problems and enabled us to make many important contributions to the development of modern, more efficient processing machinery.

When you are in need of roll renewals or are ready to specify for new processing equipment, consult us. Our engineering experience and production facilities are at your service.

UNITED ENGINEERING AND FOUNDRY COMPANY

PITTSBURGH, PENNSYLVANIA

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Subsidiaries:

Adamson United Company, Akron, Ohio
Lobdell United Company, Wilmington, Delaware
Stedman Foundry and Machine Co., Inc., Aurora, Indiana

Designers and Builders of Ferrous and Non-Ferrous Rolling Mills, Mill Rolls, Auxiliary Mill and Processing Equipment, Presses and Other Heavy Machinery. Manufacturers of Iron, Nodular Iron, and Steel Castings and Weldments.

"We like the Quality of HADLEY Cements... ... WE'VE USED THEM SINCE 1919"

SOLVENT TYPE CEMENTS

HAB-U-CO HAD-U-TEX

LATEX TYPE CEMENTS

These Cements and Compounds, available for rubber, leather, shoe, cloth, and paper manufacturers and converters, combine flexibility with maximum bond strength. Vulcanizing, pressure-sensitive and quick-setting types for specific uses.

SEND FOR SAMPLES

RESIN EMULSION EXTENDERS and TACKIFIERS

For Natural, Neoprene and GRS Latices

HAB-U-CO

HAB-U-FLEX

SPRAY FINISHES, TOO!

Clear and pigmented types for rubber and rubber-like surfaces. Dry to a beautiful sheen, permanently flexible.

SEND FOR SAMPLES

THESE PRODUCTS MANUFACTURED UNDER CLOSE LABORATORY CONTROL

SINCE 1919

HADLEY BROS.-UHL Company

514 CALVARY AVE. • ST. LOUIS 15, MO.

VULCANIZED VEGETABLE OILS

—RUBBER SUBSTITUTES—

•

Types, grades and blends for every purpose, wherever Vulcanized Vegetable Oils can be used in production of Rubber Goods—be they Synthetic, Natural, or Reclaimed.

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A LONG ESTABLISHED AND PROVEN PRODUCT

THE CARTER BELL MFG. CO. SINCE CARTER BELL PRODUCTS 1903 SPRINGFIELD, NEW JERSEY

Represented by:

HARWICK STANDARD CHEMICAL CO.

Akron — Boston — Trenton — Chicago — Denver — Los Angeles

CUTTING PAD *used to back up clicking machine shown above operated for 8 months. Close-up shows lack of effect on* PLIO-TUF *of severe impact repeated thousands of times.*

UNDER the cutting knife of a clicking machine, this PLIO-TUF pad you see has been taking constant blows from the sharp blade for over 8 months—6 three-shift days a week. Yet after many thousands of cuts, the pad shows relatively little wear and no evidence of chipping or dusting. Even the few signs of this hard service can be easily removed, because the thermoplastic PLIO-TUF can be resurfaced by a simple re-pressing operation.

PLIO-TUF can be compounded from Goodyear's PLIOLITE S-6 or S-6C and the rubber of your choice. And you'll find that PLIO-TUF gives you all these advantages:

Hardness and rigidity — can be machined or molded to shape • Impact resistance—will not break under repeated impacts • Non-chipping, non-dusting—insures clean surfaces • Resists moisture—will retain shape desired • Light color • Thermoplasticity • Light weight • Chemically resistant • Flexibility of physical characteristics

PLIO-TUF is in use in protective equipment, textile spool ends, chemical pipe and container manufacture, carrying cases and tote boxes, in sporting goods—wherever impact resistance and other properties above are important. It will fit into your production plans, too.

Although the PLIOLITE S-6 resins are currently in short supply, start your laboratory work now as normal availability will return.

Write today for full details and samples for your own appraisal to:

Goodyear, Chemical Division, Akron 16, Ohio

GOODYEAR

Plio-Tuf, Pliolite—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

ARCCO RESIN EMULSIONS
REINFORCERS
TACKIFIERS
EXTENDERS

For Natural, GRS and Neoprene Rubber Latex

As REINFORCERS for:

PLUSH BACKSIZING COMPOUNDS

RUBBERIZED COMPOUNDS FOR FIBER AND HAIR

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SCRAP FOAM RUBBER LATEX BINDERS

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ARCCO Reinforcers increase tensile strength and adhesion

As TACKIFIERS for:

Adhesives in shoe, leather, paper converting and packaging industries

ARCCO Tackifiers provide good dry pressure, sensitive tack, increased adhesion and bond strength.

Improve your product and extend your rubber supply.

Write today for complete data

AMERICAN RESINOUS CHEMICALS CORPORATION

RESIN EMULSIONS, SOLUTIONS AND HOT MELTS FOR ADHESIVE BASES, BINDERS, COATINGS, SIZES AND SATURANTS

GENERAL OFFICES: *103 FOSTER STREET, PEABODY, MASSACHUSETTS*

STAMFORD "FACTICE" VULCANIZED OIL

(Reg. U. S. Pat. Off.)

Our products are engineered to fill every need in natural and synthetic rubber compounding wherever the use of vulcanized oil is indicated.

We point with pride not only to a complete line of solid Brown, White, "Neophax" and "Amberex" grades, but also to our aqueous dispersions and hydrocarbon solutions of "Factice" for use in their appropriate compounds.

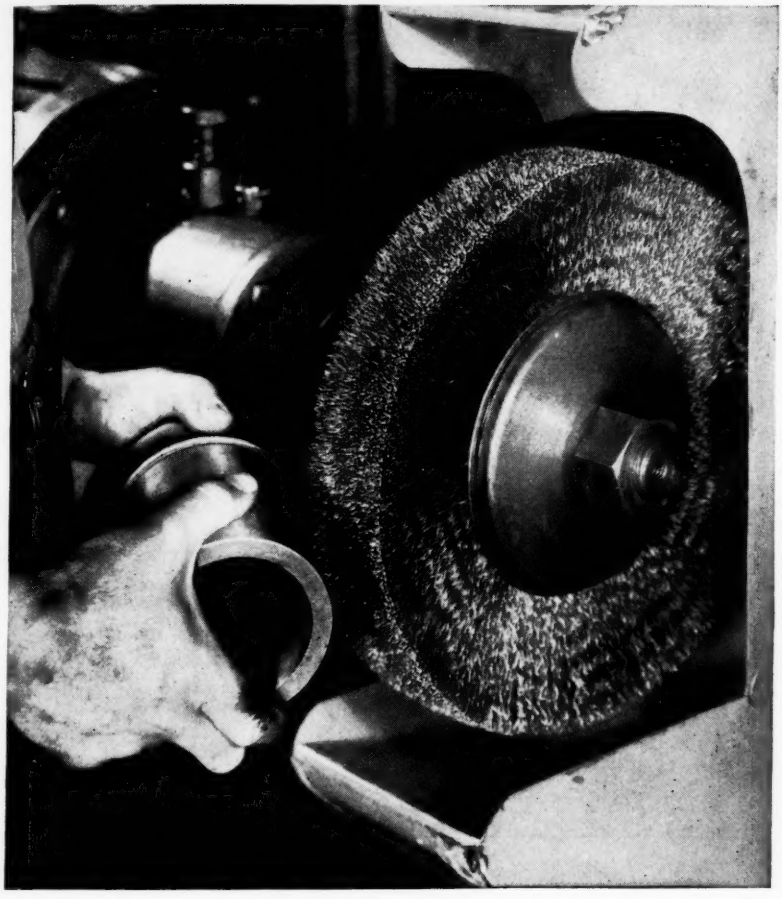
Continuing research and development in our laboratory and rigid production control has made us the leader in this field.

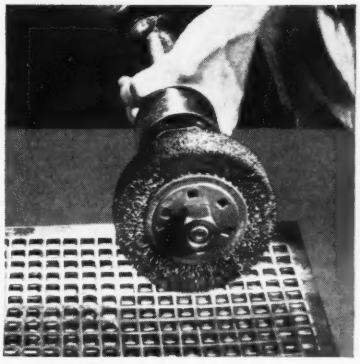
The services of our laboratory are at your disposal in solving your compounding problems.

THE STAMFORD RUBBER SUPPLY COMPANY

Stamford, Conn.

Oldest and Largest Manufacturers of "Factice" Brand Vulcanized Oil Since 1900





TURNS HOURS TO MINUTES *on jobs like this. Here a 6" Osborn Master Wheel Brush, mounted on a portable tool, removes old paint easily and quickly.*

What puts zip into 1001 "removing" jobs?

BUILT TO LAST! *This cut-away section of an Osborn Master Wheel shows its solid unit construction. Steel wire sections are gripped by two steel face plates brought together under 3½ tons pressure. Brush is densely filled and has wide face. Slips on and off shaft quickly. Has Osborn's special crimped wire. Evenly balanced to make it a smooth-running tool.*

...The right brush! The world's favorite general purpose power brush for saving man-hours on surface cleaning jobs is the Osborn Master® Wheel Brush. This dense, wide-face wire wheel brush cuts fast and lasts for a long, long time on all kinds of work such as:

Removing scale from steel parts (as shown above) . . . preparing surfaces for welding . . . removing rust, grit and old paint . . . deburring metal parts . . . roughing up rubber.

Make sure your production and maintenance departments are using Osborn Master Wheel Brushes to save man-hours! Order them from your Industrial Distributor along with other mill supplies. *The Osborn Manufacturing Company, Dept. 477, 5401 Hamilton Ave., Cleveland 14, O.*

SAVE PURCHASING TIME *by ordering all your Osborn Maintenance Brushes automatically from your Industrial Distributor along with other mill supplies.*

OSBORN

LOOK FOR THE NAME OSBORN . . . RECOGNIZED EVERYWHERE FOR QUALITY WORKMANSHIP AND MATERIALS

Rubber

natural

synthetic

SJP

HERE'S HOW

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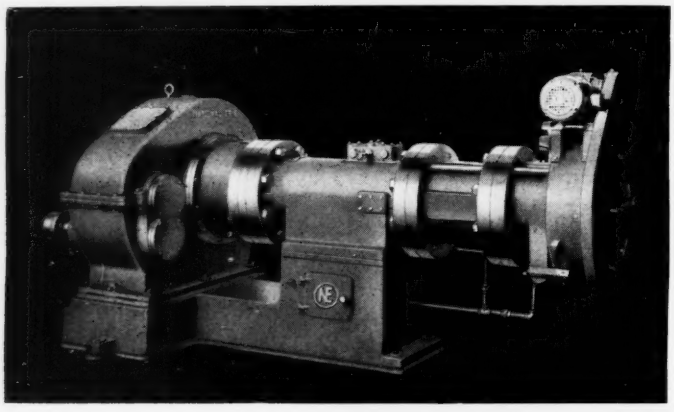

Note how Head—Cylinder—Thrust—Gear Reduction and Stock Screw units are engineered for accessibility in this NE 8 1/2" Dehydrator-type Strainer.

View shows unit in operation during World War II in large Copolymer Plant.

DEWATERING STRAINERS

Typical of the NE line of Dehydrator-type Strainers is this 8 1/2 inch unit operating in a large synthetic rubber plant. These strainers are standardized in sizes 4 1/2" through 12". They feature NE unit construction, which provides ready accessibility to each section. Hydraulic jacks designed into the unit make it easy to break the tight seal provided. A motor driven material "cut-off" facilitates operation of this high production machine.

Consult with NE engineers whose facilities include 3 large steel casting foundries and one of the industries most modern machine shops. Write for bulletin "NE Tubers & Strainers".

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June

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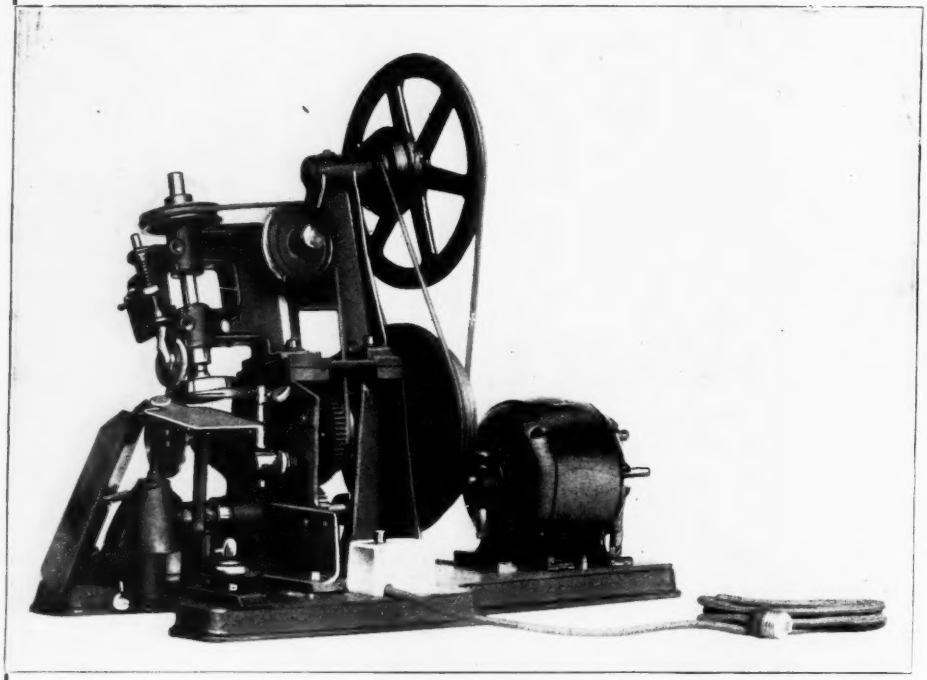

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for all purposes

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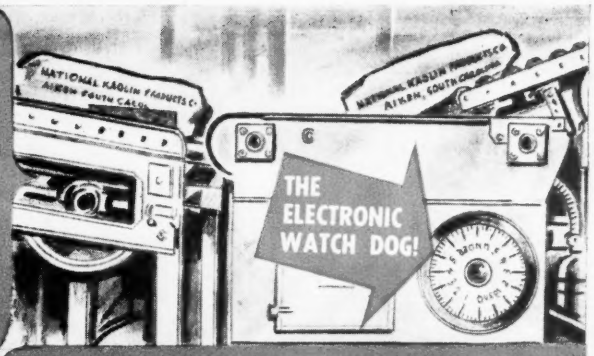
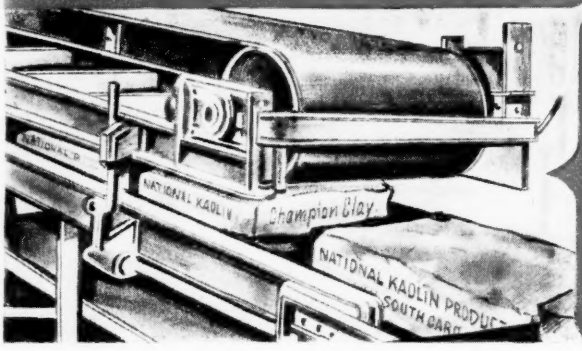
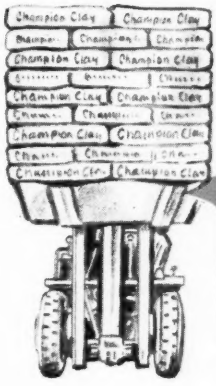




COMPACT COMPRESSED . . .

Each bag of Champion Clay goes through special pressing equipment on the conveyor line. This squeezes out all the air, makes the bag a compact, compressed unit, less bulky, easier to handle and not so easily broken during shipment or unloading. This is ANOTHER CHAMPION VALUE!

• Yes, you get all these values with CHAMPION Clay plus the fine, light quality that means so much in your finished products. Champion brings you SAVINGS, a vitally important item today in mounting production costs . . . Check these illustrated features in Champion's processing and packing and you can understand where your own handling costs and waste can be reduced . . . Whatever the quantity needed for your compounding requirements CHAMPION can bring you helpful economy.



PALLET OR "ChamPak" UNIT PAK...

A pioneer in unit loading with expendable pallets, Champion has now developed the "CHAMPAK" — a unit pack without a pallet . . . Compact, preformed bags are assembled and held together in a unit for fork-truck handling. This keeps the load solid in transit, reduces breakage and waste, provides handling economy. This is ANOTHER CHAMPION VALUE!

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REDUCE SOLIDS

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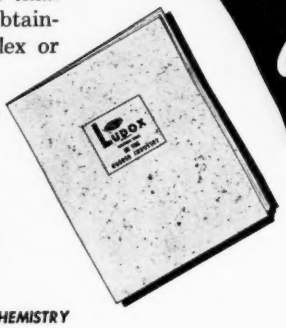

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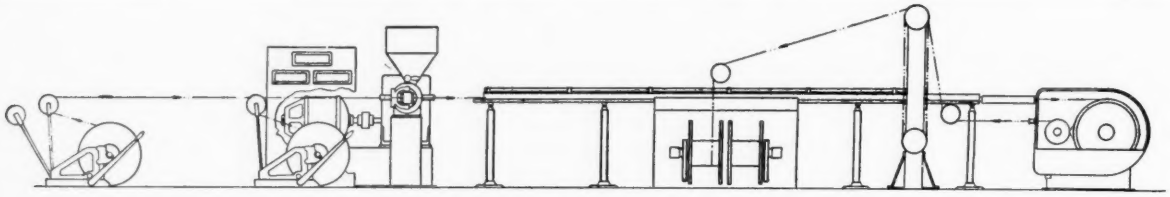
shows how you can use Du Pont "Ludox" colloidal silica in your latex products. Write: E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Department, IRW-6, Wilmington 98, Delaware.



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A complete line of rubber and plastics extruders

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PANAFLEX BN-1 is an economical, light-colored plasticizer for synthetic rubber — especially butadiene-acrylonitrile type.

This hydrocarbon plasticizer *completely* replaces dibutyl phthalate in nitrile rubbers—produces soft vulcanizates having high tensile, excellent elongation, and very low modulus. **PANAFLEX BN-1** plasticized stocks possess good ageing properties, superior electrical characteristics, and show good gasoline and oil resistance.

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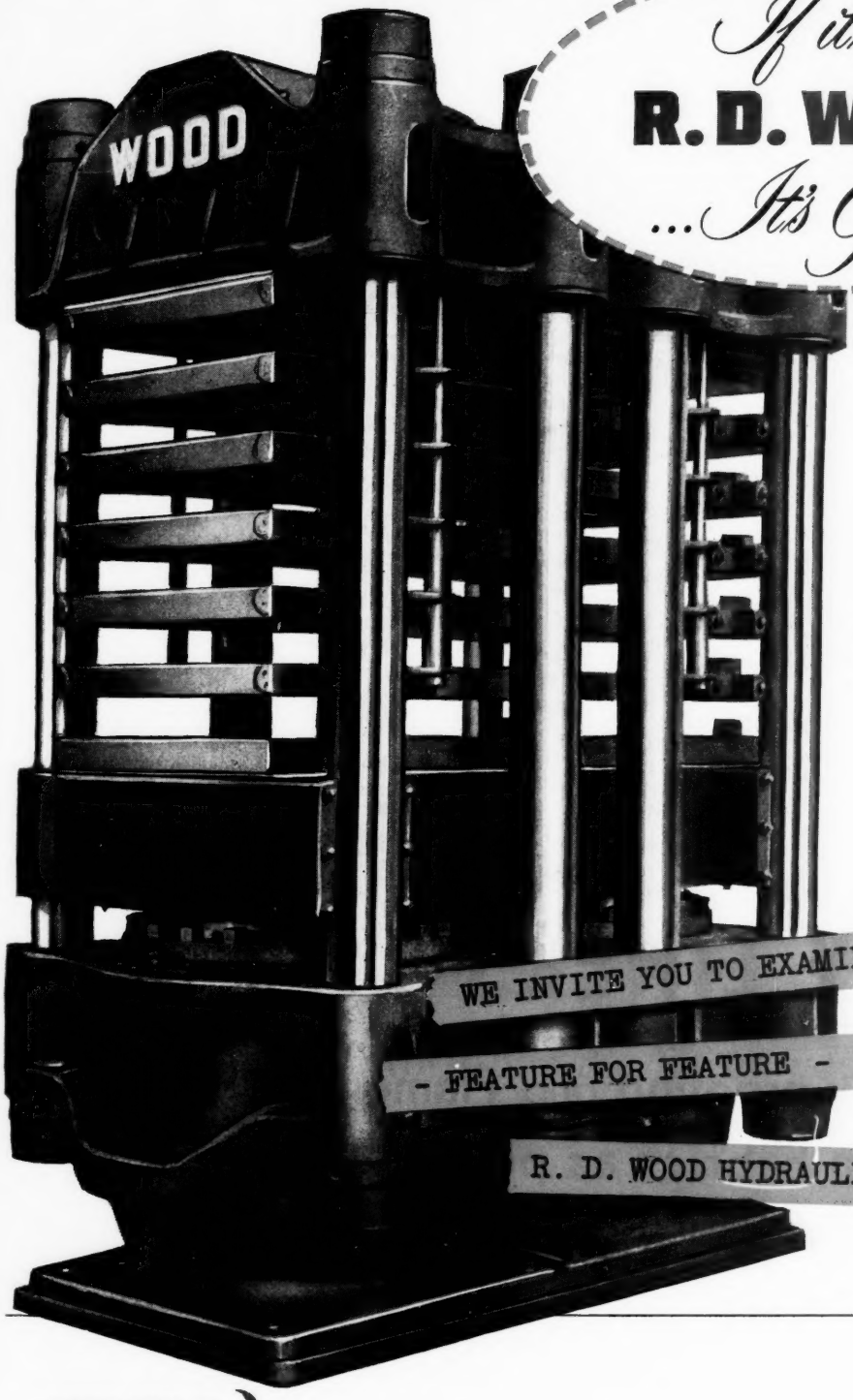

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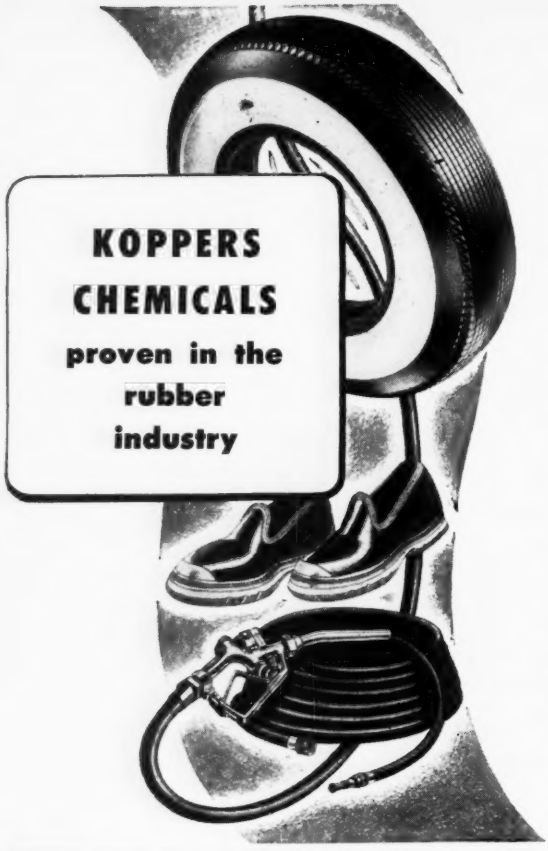

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★**DI-tert-BUTYL-para-CRESOL** has wide application as an antioxidant in white rubber products. It retards cracking, checking, hardening or loss of strength without discoloring the product or staining materials with which the product comes in contact.

★**STYRENE MONOMER** polymerizes with active olefinic compounds to produce GR-S type synthetic rubbers.

★**DI-tert-BUTYL-meta-CRESOL** is suggested for use in the preparation of hard rubber or ebonite from GR-N synthetic rubbers. It is reported to improve tensile strength of ebonite and increase tackiness of the stock. Sulfides of DBMC have been reported to be effective peptizing agents for reclaiming of GR-S type synthetic rubbers.

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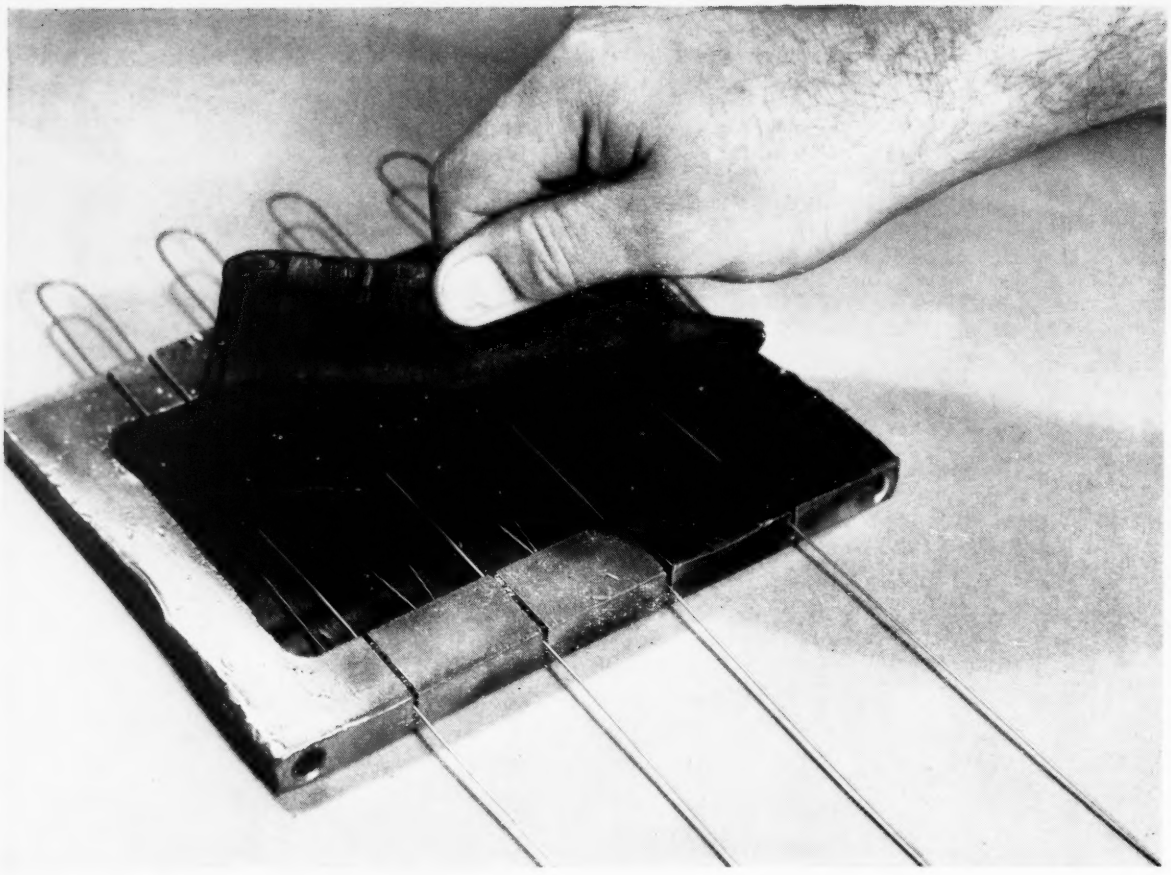

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to help your wire do a better job!

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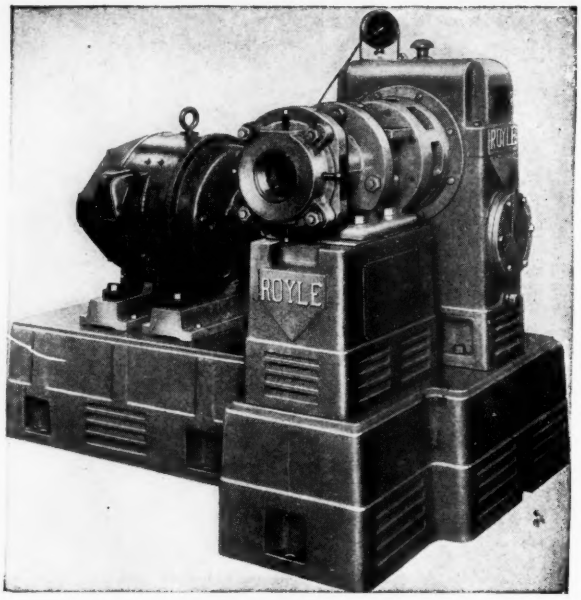
Send for your copy of Bulletin No. 448. It describes these features and how they may be applied to older type extruders.



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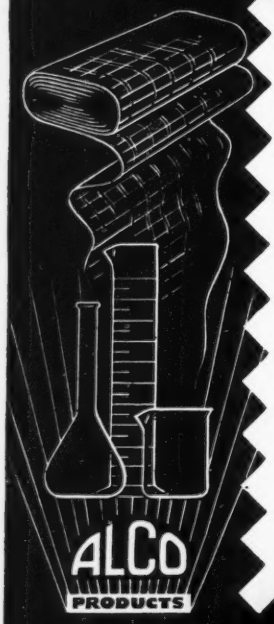

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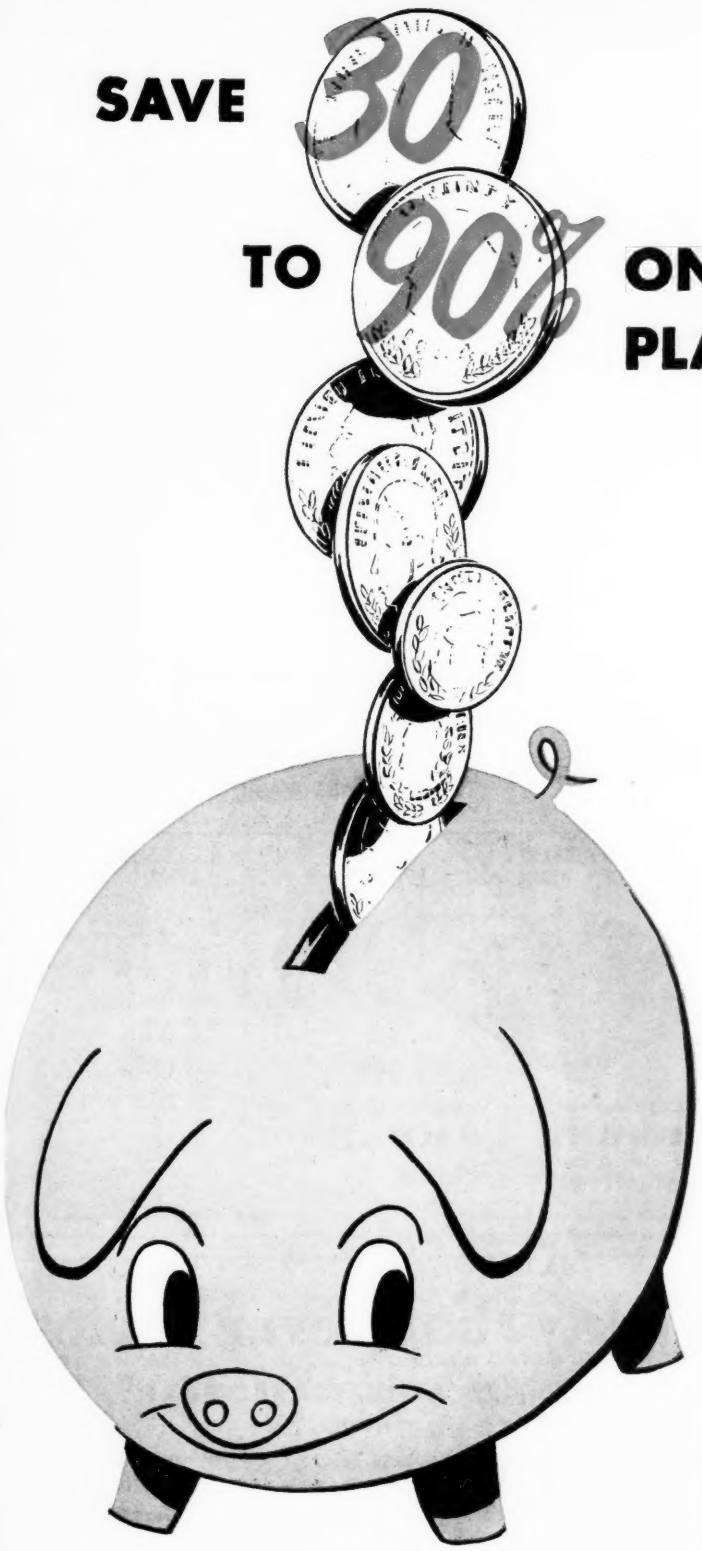

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This easy-to-handle plasticizer not only costs one-third to one-tenth *less* than conventional esters, but also produces compounds with much greater elongation at no sacrifice in tensile strength. In addition, *S/V Sovaloid C* has exceptional solvent power even for oil-resistant nitrile rubbers, making it especially desirable for polymers such as Hycar, Paracril, Butaprene and Chemigum.

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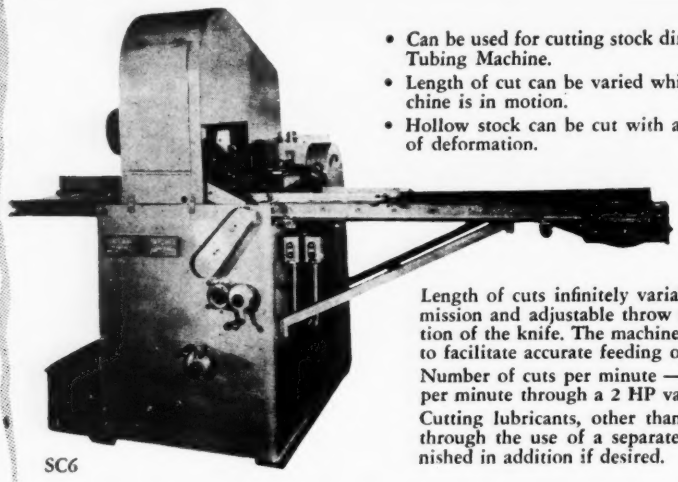

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- Length of cut can be varied while the machine is in motion.
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FOR
cutting cured and uncured rubber stocks

Length of cuts infinitely variable through a positive variable transmission and adjustable throw eccentric, sychronized with the operation of the knife. The machine is equipped with driven stripper belt to facilitate accurate feeding of the stock.

Number of cuts per minute — infinitely variable for 20 to 160 cuts per minute through a 2 HP variable speed main drive.

Cutting lubricants, other than water, can be economically applied through the use of a separate recirculating unit which can be furnished in addition if desired.

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6 ft. long 12" wide input conveyor and top snubber roll.
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Machine is equipped with anti-friction bearings throughout, and all gears and drives units are completely enclosed and run in oil for efficient lubrication.

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Produce more uniform vulcanizates and improve aging properties with NEVOLL, a liquid coal-tar softener in natural and synthetic rubber.

You will obtain high tensile strength and modulus, excellent tear and abrasion resistance and low compression set.

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R-44

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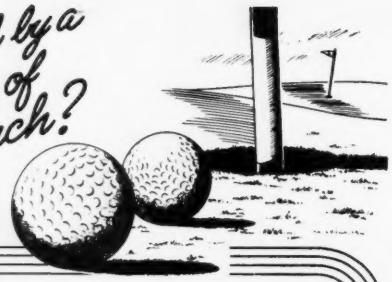

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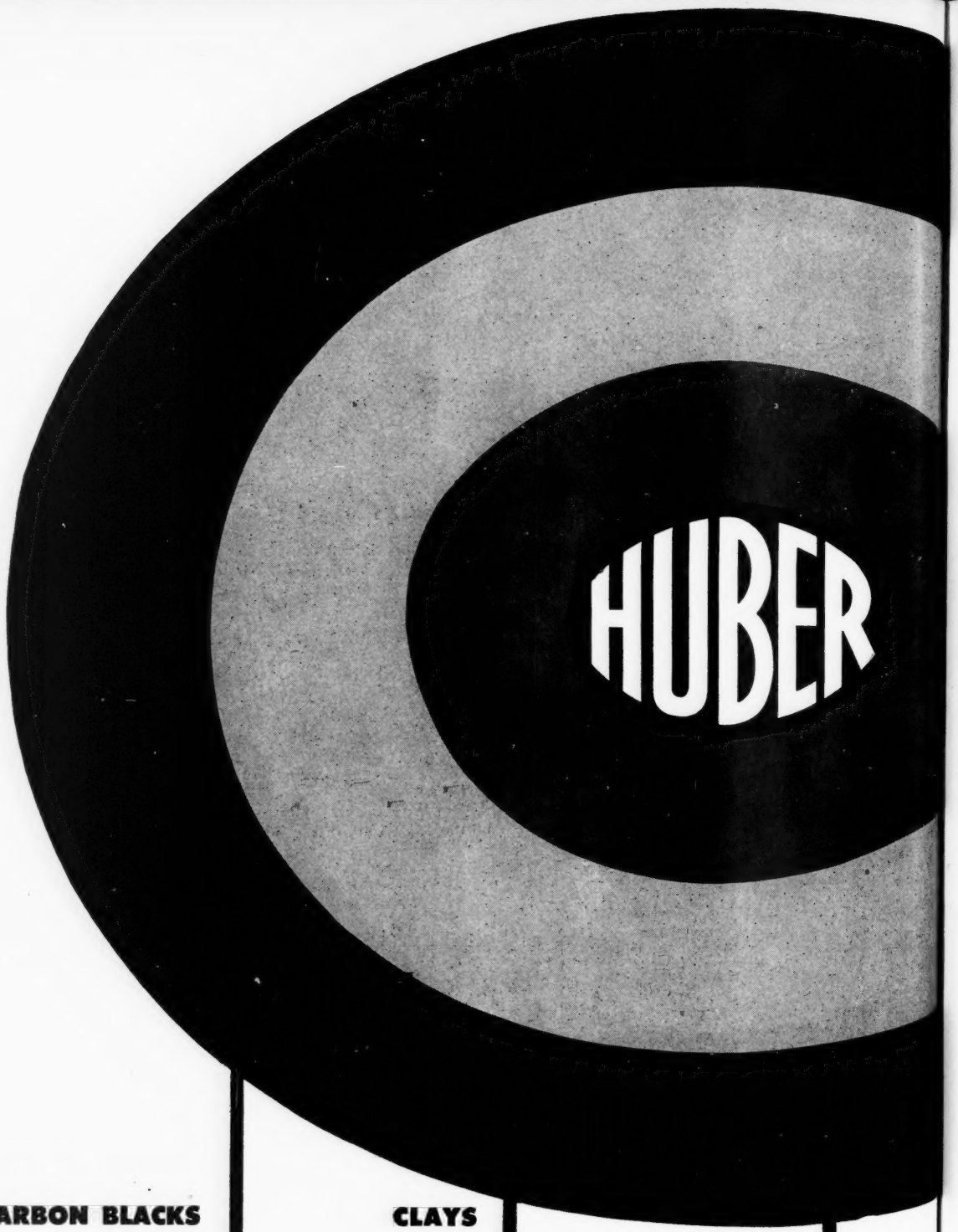

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Table of Contents

A Study of Plasticized High Mooney Viscosity Synthetic Rubbers
G. H. Swart, E. S. Pfau, K. V. Weinstock 309

A Review of the Mechanism of Flex-Cracking and Flex-Cracking Tests—I
J. M. Buist and G. E. Williams 320

Classification of Thermoplastic Resins from Their Plasticity Curves
William H. Willert 324

Rubber Division September Meeting in New York 328

Departments

Editorials 323
Plastics Technology 324
Scientific and Technical Activities 328
News of the Month:
United States 339
Canada 355
Obituary 355
Financial 356
New Machines and Appliances . 360
Rubber Industry in Europe 364
Book Reviews 372
New Publications 372
Bibliography 374

Market Reviews

Crude Rubber 376
Reclaimed Rubber 376
Scrap Rubber 376
Cotton and Fabrics 376
Rayon 378
Compounding Ingredients 380

Statistics

United States, for January, 1951 . 386
Imports, Exports, and Reexports of Crude and Manufactured Rubber 386
Tire Production, Shipments, and Inventory 386
CLASSIFIED ADVERTISEMENTS . 381
ADVERTISERS' INDEX 387

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VOL. 124 — NO. 3 JUNE, 1951

A Study of Plasticized High Mooney Viscosity Synthetic Rubbers

G. H. Swart,[1] E. S. Pfau,[1] and K. V. Weinstock[1]

THIS work was originally initiated to investigate the possibility of plasticizing very high Mooney viscosity synthetic rubbers of the butadiene copolymer type with inexpensive softeners such as petroleum oils to give low-cost rubber compounds for use in mechanical goods. We have found that polymers in a Mooney viscosity range well above that generally considered usable can be plasticized to give processable synthetic rubbers. In combination with reinforcing pigments, these plasticized high-viscosity synthetic rubbers give cured compounds with physical properties essentially equivalent to standard GR-S polymers compounded and processed in the conventional manner. A definite amount of plasticizer is necessary for each polymer of a given Mooney viscosity in order to make stocks having both optimum physical properties and adequate processability. For our work we have considered the optimum amount of plasticizer as that necessary to give a 60 compounded Mooney viscosity in a tread-type compound.

For polymers of any given viscosity, amounts of plasticizer above or below the optimum level tend to produce either lower physical properties or poorer processing. With very high Mooney viscosity synthetic rubbers, adequate processability and physical properties nearly equivalent to standard GR-S have been obtained by adding as much as 100 parts of plasticizer to 100 parts of polymer along with 100 parts of HAF carbon black. Thus, by using these very tough synthetic rubbers, inexpensive oils can replace GR-S pound for pound up to very high loadings with no appreciable loss in the quality and processability of the finished compounds when compared to those of standard GR-S. This process can be used to prepare suitable compounds for high-quality treads as well as for mechanical goods.

This present advance in rubber technology has been one of compounding. Most of the work in this development has been done with butadiene-styrene copolymers of the GR-S type because of their low cost and extensive use. It has also been found, however, that copolymers of butadiene with other vinyl monomers, such as methyl methacrylate, 3,4-dichlor-alpha-methylstyrene, and methyl isopropenyl ketone, prepared to high-viscosity levels are also readily adaptable to this plasticization process. As a general rule, compounds having optimum properties for a given oil loading are obtained when the amount of carbon black added to the plasticized rubber is calculated on the same basis that would be used if a weight of GR-S equal to the weight of high Mooney viscosity synthetic rubber plus plasticizer were being compounded. In other words, the mixture of oil and high Mooney rubber can be considered and utilized as if it were all rubber.

[1] Research laboratory, General Tire & Rubber Co., Akron, O.

INDIA RUBBER WORLD is pleased to present for the first time a complete disclosure of the process developed by The General Tire & Rubber Co.'s research laboratory by which synthetic rubbers of very high Mooney viscosity, previously considered unusable by the rubber industry, may be combined with certain petroleum oil softeners to give stocks of excellent quality.

The present advance in rubber technology is one of compounding. Most of the work in this development has been done with butadiene-styrene copolymers of the GR-S type, but copolymers of butadiene with other vinyl monomers may also be used. To realize the maximum physical properties obtainable from high Mooney viscosity rubbers and have compounds which handle satisfactorily in the usual rubber machinery, there is an optimum amount of plasticizer for each polymer of different viscosity level. By using very tough synthetic rubbers, inexpensive oils can replace GR-S pound for pound up to very high loadings and with no appreciable loss in quality and processability of finished compounds when compared to those of standard GR-S.

The increased amount of finished stock which results from the use of plasticized high-viscosity rubber could add materially to the output of the synthetic rubber industry and the rubber goods industry and at a lower cost. The synthetic rubber industry would seem assured of an improved economic position if this new development were adopted generally, even though the price of natural rubber were to be greatly reduced. EDITOR.

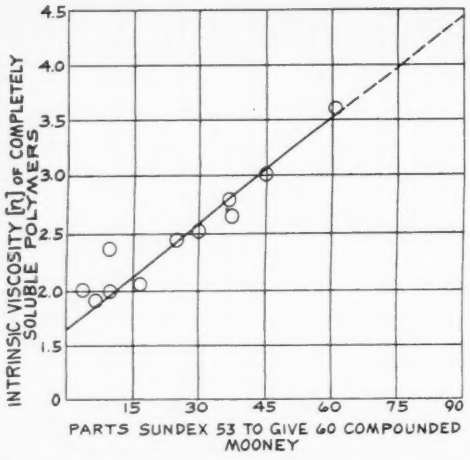

Fig. 1. Intrinsic Viscosity of Butadiene-Styrene Polymers Used to Predict Parts of Sumdex 53 to Obtain Stocks Having 60 Compounded Mooney Viscosity. (Oil Based on 100 Parts of Polymer; 50 Parts of HAF Carbon Black Used for 100 Parts of Polymer Plus Oil)

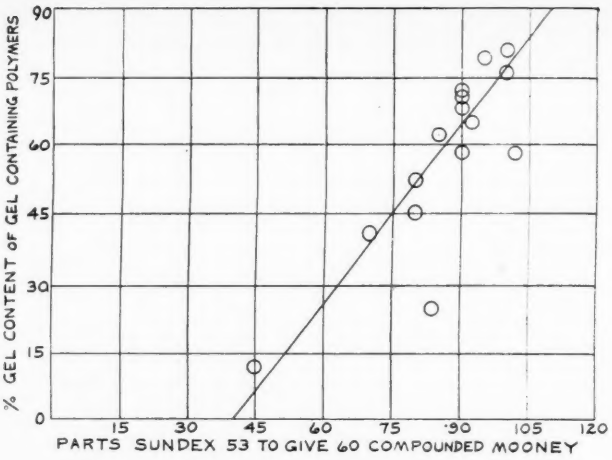

Fig. 2. % Gel Content of Butadiene-Styrene Polymers Used to Predict Parts of Sundex 53 to Obtain Stocks Having 60 Compounded Mooney Viscosity. (Oil Based on 100 Parts of Polymer; 50 Parts of HAF Carbon Black Used for 100 Parts of Polymer Plus Oil)

The plasticizers which have proved of most value are petroleum oils. A number of these oils were evaluated as softeners for high-viscosity synthetic rubbers. While no exact specifications for suitable oils can be stated at present, a few pertinent observations can be made. A wide range of aniline point appears permissible, but very high aniline point oils are not sufficiently compatible with synthetic rubbers and tend to bleed out of the compounded stock. Some of the highly aromatic oils seem to give compounds having poorer flex properties. As might be anticipated, loss of oil from stocks at high temperatures, 300° F. for example, is directly related to the empirical volatility of the oil as determined by placing an open container of the oil in an oven at 300° F. and measuring weight loss as a function of time. Of the various oils tested, Sundex 53 and Circosol 2XH were both satisfactory plasticizers, and both have low volatility. These two oils were used in most of the work reported here.

A number of methods for compounding the oil and carbon black into high Mooney viscosity synthetic rubbers were investigated. Three of these proved to be practical:

(1) The oil was emulsified in water, and the emulsion added to the synthetic rubber latex. The mixture, warmed to about 125° F., was coprecipitated by running it into salt-acid solution heated to about the same temperature. The carbon black was then added by conventional methods to the dried material on a mill or in a Banbury.

(2) The oil was emulsified and added to the latex to which had previously been added a slurry of carbon black stabilized with a suitable dispersing agent. The mixture was then "shock" coagulated at 125° F. and dried.

(3) The high Mooney viscosity synthetic rubber was mixed dry with the oil and the black in a Banbury mixer. This type of polymer usually breaks up in a Banbury mixer into non-cohesive crumbs which readily absorb oil because of the large surface area exposed. The order of addition of oil and carbon black is very important for the oil should be added to the rubber first. Carbon black can then be added to the rubber-oil mixture. A few minutes are required to work the mix into a cohesive mass, although in some cases large crumbs remain until they are passed through the sheeting-off mill. One pass through the mill is sufficient to form a working band, and the rubber-oil-black stock can then be handled in the usual manner. The power requirements for this type of Banbury mixing are not excessive, and the peak power load does not exceed that of a standard mix.

The mixes obtained from all three methods can be readily processed on conventional rubber machinery and yield finished rubber compounds with equivalent properties.

The amount of oil required to give a compounded stock having optimum physical properties at a given compounded Mooney viscosity has been found to be a linear function of the Mooney viscosity of the crude polymer. The practical application of this relationship is limited by the fact that it is not possible to make an accurate measurement of the Mooney viscosity of a very tough polymer, for when this value is much above 130, the polymer tends to tear and crumble in the Mooney machine. Some interesting relationships have been worked out, however, which make it possible, on starting with any given high molecular weight polymer, to determine the amount of a specific oil required to make a compound of 60 Mooney viscosity. Similar relationships can be established for other desired compounded Mooney viscosities.

Two of these relationships are shown in Figures 1 and 2. When the intrinsic viscosities of solutions of various samples of the same kind of polymers are plotted against parts of an oil to give a 60 compounded Mooney viscosity, a linear relationship is found for polymers containing no gel. The parts of oil are based on 100 parts of synthetic rubber, and the HAF carbon black content is one half the total weight of polymer plus oil. A graph of intrinsic viscosity against parts of Sundex 53 to give a 60 compounded Mooney viscosity is shown in Figure 1 for a series of 41° F. butadiene-styrene copolymers. For polymers which do contain gel, Figure 2 shows the relationship between parts of oil to give a 60 compounded Mooney viscosity and the gel content of the polymer.

Hence, having once set up the diagrams experimentally, it is possible to determine the approximate amount of oil and carbon black required to give a 60-Mooney viscosity compound in the following manner: First determine the gel content of the unpigmented polymer. If gel is present, the amount of oil required can be read directly from Figure 2. The amount of carbon black required will then be half the total weight of polymer

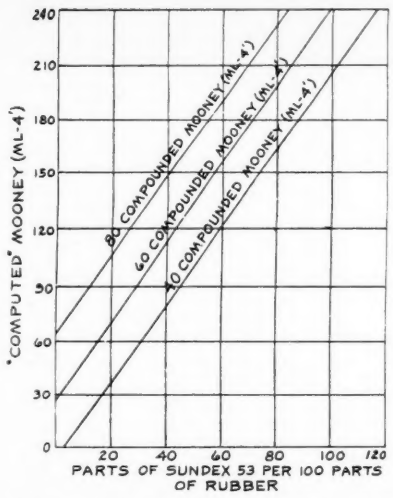

Fig. 3. Relation between Parts of Sundex 53 and "Computed" Mooney Viscosity of Butadiene Polymers to Give Various Compounded Mooney Viscosities. (Oil Based on 100 Parts of Polymer; 50 Parts of HAF Carbon Black Used for 100 Parts of Polymer Plus Oil)

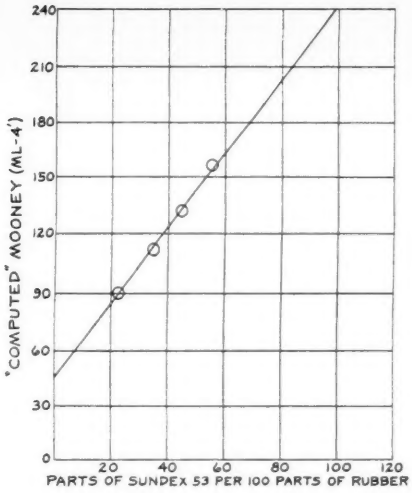

Fig. 4. Relation between Parts of Sundex 53 and "Computed" Mooney Viscosity of Butadiene-Styrene Polymers to Give 50 Mooney Viscosity for Polymer-Oil Mixtures

plus oil. But if the polymer contains no gel, the intrinsic viscosity of its solution must then be determined, and the amount of oil required can then be read from Figure 1. The use of % gel content to estimate the amount of oil required is admittedly a first approximation. We believe that the swelling index of the gel and the intrinsic viscosity of the soluble portion should also be considered as more data are accumulated in order to obtain a more precise estimation. The data on which Figures 1 and 2 were based are shown in Table 1. Gel, swelling index, and intrinsic viscosity values were obtained as described by Yanko.[2]

TABLE 1. SOL-GEL PROPERTIES AND PARTS OF SUNDEX 53 TO GIVE 60 COMPOUNDED MOONEY VISCOSITY FOR TYPICAL 72-28 BUTADIENE-STYRENE COPOLYMERS

(Oil based on 100 parts of polymer; 50 parts of HAF carbon black used for 100 parts of polymer plus oil)

Temperature at Which Polymer Was Made—° F.	% Gel	Swelling Index	Intrinsic Viscosity	Parts Sundex 53 to Give 60 CML-4
41	90	13	1.59	110
	81	19	1.35	100
	79	19	1.30	95
	76	20	1.29	100
	72	26	1.65	90
	71	28	1.42	90
	68	28	1.44	90
	62	41	1.62	85
	58	33	1.58	90
	58	37	2.04	102
	52	53	1.72	80
	45	50	1.36	80
	41	144	3.06	70
	25	139	3.49	84
	12	284	2.25	45
	1	..	3.60	61
	0	..	3.00	45
	0	..	2.79	37
	0	..	2.52	30
	0	..	2.44	25
	0	..	2.06	17
	0	..	2.00	10
	0	..	1.91	7
122	65	52	1.27	93
	2	..	2.69	38
	0	..	2.36	10
	0	..	2.00	4

The third of these relationships is shown in Figure 3. A plot of the Mooney viscosity of a given crude polymer against parts of oil required to plasticize the polymer to a given compounded Mooney viscosity is linear. With sufficient data similar plots can be drawn for other compounded viscosity levels besides those shown in Figure 3. These lines can then be extrapolated to show the corresponding relationships that should exist for raw polymers with such high Mooney viscosities that they cannot be measured accurately on a Mooney plastometer. These extrapolated Mooney values are called "computed" Mooney viscosities. When a polymer of unknown viscosity is to be processed, the compounded Mooney viscosity of one compound containing oil and carbon black is usually sufficient to estimate from the graph of Figure 3 the quantity of oil to be added in order to make a compound having any desired plasticity. This graph is very useful when several polymers of the same type, but differing in toughness, are to be processed.

A similar relationship can be established for rubber-oil mixtures containing no carbon black, as shown in Figure 4. Here the parts of Sundex 53 per 100 parts of puted" Mooney. In experimentally determining this relationship care should be exercised in drying rubber-oil mixtures to avoid heat plasticization.

From the work on the development of an oil-plasticized synthetic rubber suitable for tread stocks a number of preliminary generalizations can be made. Polymers of almost any toughness, even those having high gel contents, can be made into processable rubbers, but the difficulty of processing increases with toughness. Polymers made at low temperatures yield compounds with better physical properties and processability. Ease of processability decreases, and physical properties tend to become poorer as the amount of styrene in the polymer is reduced. In comparison with standard GR-S, the oil-plasticized polymers studied have lower rebound at room temperature, but approach that of natural rubber at elevated temperatures; have superior heat build up as determined on a Goodrich flexometer; have lower permanent set; have comparable properties as determined after aging in a circulating air oven at 212° F.; have comparable stress-strain properties; and they can be made into tread stocks which extrude at lower temperatures. Their crack resistance, as measured on a DeMattia flexing machine, is about equal to that of tread stocks made from GR-S.

[2] *J. of Polymer Scien.*, 3, 4, 576 (1948).

Experimental Work

Preparation of Polymers for Preliminary Work

Examples of the polymers used in the preliminary investigation are shown in Tables 2 and 3. These synthetic rubbers were all made in polymerization systems in common use for the manufacture of GR-S. Polymers with a wide range of Mooney viscosities were obtained by appropriate variation of the concentration of the modifier.

TABLE 2. POLYMERS PREPARED AT 41° F.

Polymer No.	Butadiene-Styrene Ratio	Modifier Concentration	Conversion %	Mooney Viscosity Initial	Mooney Viscosity Four Min.
115	72/28	0.02 MTM*	59	162	§84
116	72/28	0.10 t-C_{16}†	59	210	153
135	72/28	0.05 n-C_{16}‡	72	140	§53
137	72/28	0.05 n-C_{16}‡	72	162	§39
136	72/28	0.05 n-C_{16}‡	72	147	112
138	72/28	0.05 n-C_{16}‡	73	219	156
140	72/28	0.05 MTM	73	170	§64
141	72/28	0.15 MTM	72	135	113
142	72/28	0.25 MTM	73	110	94
143	72/28	0.30 MTM	74	..	74
153	72/28	0.5 MTM	75	..	..
122	80/20	0.02 MTM	80	160	§72
127	80/20	0.02 MTM	53	178	§104
131	90/10	0.02 MTM	78	180	§86
130	Polybutadiene	0.02 MTM	72	199	§108

* Mixed tertiary mercaptans.
† Tertiary hexadecyl mercaptan.
‡ Primary hexadecyl mercaptan.
§ Samples tore in Mooney machine.

TABLE 3. POLYMERS PREPARED AT 122° F.

Polymer No.	Butadiene-Styrene Ratio	Modifier Concentration	Conversion %	Mooney Viscosity Initial	Mooney Viscosity Four-Min.
107	60/40	0.02 n-C_{16}*	71	180	§71
110	60/40	0.02 MTM†	72	168	§45
119	60/40	0.3 t-C_{16}‡	72	116	84
121	60/40	0.1 t-C_{16}	72	134	108
123	60/40	0.02 MTM	65	143	§72
124	80/20	0.02 MTM	80	195	§126
151	90/10	0.02 n-C_{16}	91	178	§100

* Primary hexadecyl mercaptan.
† Mixed tertiary mercaptans.
‡ Tertiary hexadecyl mercaptan.
§ Samples tore in Mooney machine.

Addition of Oil to Polymers

In the earliest experiments the oil was added either directly to the latex before coagulation or to the precipitated synthetic rubber crumb in a water slurry. The following examples are typical of these experiments:

(a) To latex containing 100 parts of synthetic rubber as solids were added directly with vigorous agitation 50 parts of Circosol 2XH. The mixture was then coagulated with alum.

(b) To latex containing 100 parts of synthetic rubber were added a slurry containing 50 parts of finely divided clay and 50 parts of Circosol 2XH. The mixture was then coagulated with alum. The pigment appeared to aid in the formation of a crumb during coagulation. There was no evidence of bleeding of oil from the crumb.

(c) Latex containing 100 parts of synthetic rubber was coagulated to a fine crumb with alum. The slurry was not filtered, but instead 50 parts of Circosol 2XH were added to the slurry of crumb in mother liquor, and the mixture was well stirred. The oil was readily absorbed by the rubber, and the crumb, though sticky at first, gradually became drier as the oil diffused into the crumb. The rate of oil absorption was increased at higher temperatures.

While it was possible to make uniform mixtures of oil and synthetic rubber by these methods utilizing unemulsified oil, extremely efficient and vigorous stirring was necessary. Experiments were therefore performed using emulsified oils.

Oil emulsions containing 33% oil were readily prepared by using about 2% of a suitable emulsifying agent such as fatty acid soaps, Dresinates, sodium salts of lignin such as Indulin A, and various mixtures of these emulsifying agents. Indulin A was found to be a very useful material in the preparation of oil-rubber mixtures containing no carbon black. Used as a partial or complete replacement of the rosin or fatty acid soaps, Indulin A prevented the lumping of coagulated crumbs into balls, helped to control the particle size, and permitted a reduction in the temperature required to obtain a good coagulation.

The oil emulsions were used to introduce oil in synthetic rubber latices both with and without added carbon black. Examples of these two methods follow:

(a) An emulsion of 33 parts of oil in 67 parts of water with two parts of Indulin A was stirred into latex containing 33 parts of synthetic rubber. The mixture was then thoroughly stirred, warmed to about 140° F., and "shock" coagulated by running it into a salt-acid solution heated to 140° F.

(b) A carbon black slurry was prepared from 100 parts of black, 550 parts of water, and four parts of Indulin A, adjusted with sodium hydroxide to give a pH between 10 and 11. Circulating the mixture through a colloid mill for 15 minutes gave a good dispersion. The slurry was then added to latex containing 100 parts of polymer, and the pH was adjusted to about 10. After the mixture had been stirred for five minutes, it was heated to 140° F., and 100 parts of oil as a 33% emulsion, heated to 140° F., were then added. After the mixture had been stirred for about five minutes, it was "shock" coagulated by running it into a salt-acid solution heated to 140° F.

A method for incorporating both oil and carbon black in the dry polymer in a Banbury mixer has already been described.

Comparison of Latex and Banbury Mixing

In Table 4 are data comparing the physical properties of compounds prepared by three different methods f mixing synthetic rubber, carbon black, and oil. Compound A was dry mixed in a Banbury mixer. The oil was added to the synthetic rubber, followed by the carbon black. Compound B was made by latex mixing the oil and synthetic rubber, followed by addition of the carbon black in a Banbury mixer. Compound C was made by latex mixing the synthetic rubber, oil, and carbon black. All three mixtures of oil, synthetic rubber, and carbon black were then given a second mix in the Banbury mixer in order to incorporate the curing agents.

TABLE 4. STRESS-STRAIN DATA OF COMPOUNDS PREPARED BY DIFFERENT MIXING METHODS

Cure Time (Min. @ 287° F.)	Compound A (Dry Mixed) 15	30	45	60	90	Compound B (Rubber-Oil Latex Mixed) 15	30	45	60	90	Compound C (Rubber-Oil-Black Latex Mixed) 15	30	45	60	90
Modulus (300%)	420	1050	1195	1300	1420	310	1110	1240	1360	1475		690	1040	1110	1285
Tensile (p.s.i.)	1080	2575	2940	2890	2910	900	2820	3100	3210	3180	no	2500	3100	3115	3270
Elongation (%)	860	670	600	570	540	920	680	610	560	520	cure	690	620	590	570
Durometer Hardness	49	55	58	58	59	46	55	59	59	60		53	57	57	58

The compounds were cured at 287° F. and tested at 77° F. A cold rubber polymer having a Mooney viscosity of 130 and prepared from a charging ratio of 72 parts of butadiene and 28 parts of styrene was used. Each compound contained 100 parts of the polymer, 50 parts of Sundex 53, and 75 parts of HAF black. As shown by Table 4, the three methods give stocks having practically identical physical properties. It should be pointed out that the addition of large amounts of oil and carbon black to very tough polymers in a Banbury mixer is time consuming. It is also more difficult to obtain consistently good dispersions by dry mixing than by using latex prepared rubber-oil or rubber-oil-carbon black mixtures.

In the evaluation work to be described all three of these methods were used interchangeably; the choice rested entirely on expediency.

Comparison of Properties of Oils Used

In Table 5 are shown, for reference purposes, the physical properties and brief descriptions of some of the various oils used in these experiments. These data were supplied by the manufacturers of the oils.

Preliminary Evaluations of Compounds

A large number of preliminary experiments were made to provide comparisons of the stress-strain data of compounds containing different carbon blacks, different oils, polymers with different butadiene-styrene ratios, and polymers with different Mooney viscosities. These compounds contained 100 parts each of synthetic rubber, oil, and carbon black. For our work, however, we have considered the high-viscosity synthetic rubber and plasticizer combination as rubber. A typical tread-type recipe based on this assumption contains 100 parts of polymer-oil mixture, 50 parts of HAF black, 3.0 of zinc oxide, 1.5 to 2.0 of sulfur, 0.75 to 1.25 of Santocure, and 0 to 0.25 of Monex. A collection of such data for the polymers listed in Tables 2 and 3 is shown in Tables 6 and 7. The oil and the carbon black were incorporated in each case by latex mixing. The stress-strain data are those at optimum cure. Included in the tables are the butadiene-styrene ratios of the polymers and the amount and the kind of modifier used during the polymerization.

While the data in Tables 6 and 7 are preliminary, a

TABLE 5. PROPERTIES OF REPRESENTATIVE PLASTICIZING OILS

Oil	Manufacturer	Sp. Gr.	Saybolt Universal Viscosity at 210° F. Sec.	Pour Point ° F.	Flash Point ° F.	Aniline Point ° F.	Initial Boiling Point ° F.	Description
Sundex 53	Sun Oil Co.	0.97	90	70	380	130	...	Highly aromatic heavy-process oil.
Dutrex 6	Shell Development	1.02	142	..	...	....	600	Complex high molecular weight aromatic and unsaturated hydrocarbons.
Dutrex 7	Shell Development	1.0	93	..	440	....	...	Heavy process oil type.
Circosol 2XH	Sun Oil Co.	0.94	85	10	430	181	700	Hydrocarbons of high molecular weight derived from selected crudes.
Califlux G. P.	Golden Bear Oil Co.	1.01	110	45	...	*34	665	Blend of unsaturated components contained in naphthenic base petroleum.
Sovaloid N	Socony-Vacuum Oil Co.	1.03	44	0	350	*115	600	Oil containing about 80% aromatic hydrocarbons.
Sovaloid C	Socony-Vacuum Oil Co.	1.06	36	10	330	*66	580	Synthetic aromatic petroleum oil.
Phillips 9002	Phillips Petroleum Co.	....	..	..	...	....	...	Alkylated aromatic hydrocarbon.

* Mixed aniline point.

TABLE 6. PRELIMINARY EVALUATION OF POLYMERS MADE AT 41° F. IN COMPOUNDS CONTAINING 100 PARTS EACH OF POLYMER, OIL, AND CARBON BLACK

Polymer No.	Butadiene/ Styrene Ratio	Modifier Concentration	Oil Type	Type Carbon Black	Optimum Cure Min.	Modulus 300% P.S.I.	Tensile P.S.I.	% Elongation	Tear P.S.I.	Durometer Hardness
115	72/28	0.02 MTM*	Circosol 2XH	EPC	75	465	2235	725	230	49
			Sundex 53	EPC	45	345	2400	900	222	38
			Circosol 2XH	HAF	30	970	2300	505	208	50
			Sundex 53	HAF	45	1220	2540	555	246	51
116	72/28	0.1 t-C_{16}†	Circosol 2XH	EPC	75	685	2040	650	200	55
			Sundex 53	EPC	75	870	2040	605	206	60
137	72/28	0.05 n-C_{16}‡	Sundex 53	HAF	75	800	2400	620	322	50
138	72/28	None	Sundex 53	HAF	60	825	1640	440	322	48
140	72/28	0.05 MTM	Sundex 53	HAF	75	1340	1870	400	180	65
141	72/28	0.15 MTM	Sundex 53	HAF	60	955	1480	420	316	52
142	72/28	0.25 MTM	Sundex 53	HAF	60	980	1225	380	258	50
143	72/28	0.30 MTM	Sundex 53	HAF	60	460	970	475	250	43
122	80/20	0.02 MTM	Sundex 53	HAF	30	1580	2145	390	200	52
127	80/20	0.02 MTM	Sundex 53	HAF	30	1210	1935	410	190	51
131	90/10	0.02 MTM	Circosol 2XH	HAF	75	765	2560	500	185	46
			Sundex 53	HAF	75	1005	2235	435	146	48
130	100% Butadiene	0.02 MTM	Sundex 53	HAF	60	....	850	250	102	51
GR-S X-478	71/29	.....	Sundex 53	HAF	75	390	1130	680	186	43

* Mixed tertiary mercaptans
† Tertiary hexadecyl mercaptan.
‡ Primary hexadecyl mercaptan.

TABLE 7. PRELIMINARY EVALUATION OF POLYMERS MADE AT 122° F. IN COMPOUNDS CONTAINING 100 PARTS EACH OF POLYMER, OIL, AND CARBON BLACK

Polymer No.	Butadiene/ Styrene Ratio	Modifier Concentration	Oil Type	Type Carbon Black	Optimum Cure Min.	Modulus 300% P.S.I.	Tensile P.S.I.	% Elongation	Tear P.S.I.	Durometer Hardness
107	60/40	0.02 n-C_{16}*	Circosol 2XH	EPC	30	825	2030	560	220	40
110	60/40	0.02 MTM†	Circosol 2XH	EPC	60	690	1970	600	262	55
			Circosol 2XH	HAF	30	590	1780	615	242	50
			Sundex 53	HAF	60	1130	1910	420	162	63
119	60/40	0.3 t-C_{16}‡	Circosol 2XH	EPC	60	320	1390	700	182	42
			Sundex 53	EPC	60	245	1415	830	145	39
121	60/40	0.1 t-C_{16}	Circosol 2XH	EPC	45	1115	1715	430	169	54
			Sundex 53	EPC	45	1130	1720	400	168	57
123	60/40	0.02 MTM	Sundex 53	HAF	15	1000	2130	520	254	48
124	80/20	0.02 MTM	Sundex 53	HAF	15	940	1350	385	216	50
151	90/10	0.02 n-C_{16}	Sundex 53	HAF	30	....	760	150	94	66
Std. GR-S			Sundex 53	HAF	60	240	695	665	172	30

* Primary hexadecyl mercaptan.
† Mixed tertiary mercaptans.
‡ Tertiary hexadecyl mercaptan.

few conclusions can be drawn. For example, examination of data for polymers 138 through 143 shows that as more modifier is used in polymer preparation, resulting, of course, in decreased Mooney viscosity, the tensiles of the cured compounds containing the same amounts of black and oil steadily decrease. This point suggests the probable existence of an optimum oil loading for each polymer of specific Mooney viscosity. The data for polymer 115 in Table 6 and polymer 110 in Table 7 show that both Sundex 53 and Circosol 2XH with either EPC or HAF carbon black give compounds with good physical properties when used in the proportion of 100 parts each of carbon black and oil with 100 parts of either a 41 or a 122° F. high-viscosity polymer.

High molecular weight polymers prepared with a variety of modifiers can be plasticized with oil to yield compounds having good physical properties as seen in the data for polymers 115 (mixed tertiary mercaptans), 116 (tertiary hexadecyl mercaptan), 137 (primary hexadecyl mercaptan), all in Table 6. Similar comparisons are shown in Table 7, polymers 119, 107, and 110. That high Mooney viscosity polymers with various butadiene-styrene ratios yield compounds with good physical properties, when plasticized with large amounts of oil, can be seen in Tables 6 and 7.

Volatility of Oils

One of the early questions was whether or not oils would be removed by heat from the plasticized high-viscosity rubbers. Experiments were accordingly designed to find oils which would be relatively non-volatile. Samples of the various oils were heated in open containers at 300° F., and the weight losses were determined at one hour and three hours.

The results of these experiments are shown in Table 8 It is apparent that two of these oils, Sundex 53 and Circosol 2XH, showed relatively low volatility under the test conditions. A number of compounds containing these oils and mixtures of them were prepared. The polymer used was a 72/28 butadiene-styrene unmodified polymer made at 41° F. Also shown in Table 8 are the volatility data obtained when cured sheets of these compounds were heated at 300° F. for one-hour and three-hour periods.

TABLE 8. VOLATILITY DATA (LOSS AT 300° F.) OF OILS HEATED IN OPEN CONTAINERS AND WEIGHT LOSS FROM CURED SHEETS

Loss from Open Container (%)			% Weight Loss of Cured Sheets at 300° F.		
One Hr.	Three Hrs.	Weight % and Kind of Oil in Stocks	One Hr.	Three Hrs.	% of Total Oil Content Lost in Three Hrs.*
18	32	25 Sovaloid N	7	10	40
12	30	31 Circo Light Oil	8	17	55
1	3	31 Circosol 2XH	2	5	16
10	23	31 Diamond Process	6	15	49
3	6	27 Sundex 53	3	5	20
		12.8 Sundex 53 \ 16.2 Circo Light /	4	9	32
		12.8 Sundex 53 \ 16.2 Diamond Process Oil /	5	8	28

*This % weight lost would include, besides plasticizer, antioxidant and fatty acid from all stocks; so the data show high results.

Comparisons of Different Oils

In Table 9 are shown the physical data at optimum cure of compounds of polymer 110 in Table 3 having a Mooney viscosity of more than 150, with a number of different petroleum oils. These compounds contained equal parts of rubber, oil, and carbon black. Results with both HAF and EPC blacks are shown.

Similar data for polymer 137 of Table 2 made at 41° F. with a Mooney viscosity of more than 150 are shown in Table 10.

From the data in Tables 9 and 10 it can be seen that a wide variety of petroleum oils can be used to convert the high-viscosity polymers to compounds having reasonably good physical properties.

A more extensive study of the properties of compounds containing eight different petroleum oils with the same polymer is shown in Table 11. The polymer used was a 41° F., 72/28 butadiene/styrene polymer having a measured raw Mooney viscosity of 150, a gel content of 41%, and a swelling index of 144. From the method of preparation with 0.05-part mixed tertiary mercaptan as modifier and from the sol-gel data, it is probable that the "computed" Mooney of this polymer was about 200, indicating a much tougher polymer than suggested by the raw Mooney viscosity. The compounds tested contained 100 parts of polymer, 60 parts of plasticizer, and 75 parts of HAF carbon black. They were dry mixed in a Banbury. The compounded Mooney viscosities obtained and recorded are not truly representative in this particular series since the stocks were given some additional milling to insure adequate dispersion of black.

Table 11 lists physical properties obtained with each of the plasticizers. Stocks containing Sundex, 53, Dutrex 6, Dutrex 7, Circosol 2XH, and Califlux GP gave good balance of physical properties at room temperature and at 205° F. and also retained these properties to a greater extent than any of the other three stocks after oven aging. Dutrex 6 and Dutrex 7 gave the best flexing of any of these oils. All of these first five low-cost petroleum oils gave compounds at optimum cure with original tensiles at room temperature in excess of 3000 p.s.i. and elongations of about 600%. A tensile of about 1700 p.s.i. with an elongation of more than 400% was retained at 205° F. The stocks gave over 2700 p.s.i. tensile with an elongation of more than 400% after aging 48 hours

TABLE 10. PHYSICAL PROPERTIES OF A 72/28 BUTADIENE/STYRENE POLYMER MADE AT 41° F. COMPOUNDS CONTAIN 100 PARTS EACH OF RUBBER, OIL, AND HAF BLACK

Type Oil	Cure Min.	Modulus 300% P.S.I.	Tensile P.S.I.	% Elongation	Tear P.S.I.	Durometer Hardness
Sundex 53	75	800	2400	620	322	50
Sovaloid C	60	900	2380	530	360	51
Socony Vacuum 35/65	60	835	1590	450	326	48
Neville Heavy Oil	75	670	2120	705	394	50
#40 Process Oil	30	1280	2150	420	280	60
Sovaloid N	75	790	1980	520	312	50
Avon Annalos #3	45	1190	2260	480	252	55

TABLE 9. PRELIMINARY OIL EVALUATION IN A 60/40 BUTADIENE/STYRENE 122° F. POLYMER IN COMPOUNDS CONTAINING 100 PARTS EACH OF POLYMER, OIL AND CARBON BLACK

Oil Type	Carbon Black	Cure Min.	Modulus 300% P.S.I.	Tensile P.S.I.	% Elongation	Tear P.S.I.	Durometer Hardness
Sundex 53	HAF	60	1130	1910	420	162	63
Neville Heavy Oil	HAF	45	1040	1810	440	165	63
Sovaloid C	HAF	45	1050	1840	416	153	60
Socony Vacuum 35/65	HAF	30	1010	1760	415	157	64
Circosol 2XH	HAF	45	1080	1460	360	143	62
908 Processing Oil	HAF	45	1010	1490	380	115	61
Circo Light Oil	HAF	30	1070	1490	350	102	62
Dutrex 6	HAF	45	1070	1490	360	91	59
Neville Heavy Oil	EPC	60	855	1835	520	300	65
Sovaloid C	EPC	60	1020	1730	435	240	58
908 Processing Oil	EPC	60	1075	1610	400	222	63
Circosol 2XH	EPC	75	580	1710	565	204	60
Dutrex 6	EPC	60	1020	1360	400	163	59

TABLE 11 PHYSICAL PROPERTIES OF COMPOUNDS CONTAINING 60 PARTS OF OIL, 75 PARTS OF HAF CARBON BLACK AND 100 PARTS OF A 72/28 BUTADIENE/STYRENE POLYMER MADE AT 41° F.

Type-Oil	Sundex 53					Dutrex 6					Dutrex 7					Circosol 2XH				
Cures @ 287° F., min.	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75
Original Tested @ 82° F.																				
Tensile, p. s. i.	430	2720	3250	3300	3300	800	3000	3140	3300	3360	780	3160	3280	3440	3460	635	2850	3260	3050	3280
% elongation	1105	795	700	640	615	1050	755	680	665	635	975	790	675	655	650	965	765	635	600	590
Modulus @ 300%, p.s.i.	108	540	840	1020	1120	425	660	900	1060	1080	161	890	1100	1000	1320	238	700	1060	1060	1200
Tear*, p.s.i.	117	380	276	292	272	212	400	380	324	270	214	420	360	302	350	194	274	260	270	274
Durometer hardness	40	46	50	53	53	42	50	52	54	55	45	50	52	53	54	40	49	50	52	53
Original Tested @ 205° F.																				
Tensile, p.s.i.	220	1400	1715	1700	1730	375	1765	1395	1750	1805	380	1805	1730	1800	1570	320	1565	1675	1590	1495
% elongation	625	590	515	440	425	690	640	425	440	450	640	640	490	465	425	615	565	450	415	390
Modulus @ 300%, p.s.i.	145	560	725	1105	1030	160	680	900	1115	1016	160	640	855	1005	1090	160	615	920	1095	1200
Aged 48 Hrs. @ 212° F. Tested @ R. T.																				
Tensile, p. s. i.	2405	2575	2740	2830	2790	2480	2590	2730	2720	2505	2355	2780	2775	2770	2740	2490	2780	2685	2700	2740
% elongation	630	435	440	450	480	600	475	470	475	450	590	510	500	500	500	580	450	390	405	400
Modulus @ 300%, p.s.i.	915	1580	1715	1720	1665	990	1460	1540	1520	1500	995	1380	1470	1410	1420	990	1655	1930	1765	1890
Durometer hardness	54	60	60	60	60	55	58	59	59	59	55	57	58	58	58	52	58	60	60	60
Compounded Mooney (ML-4')																				
				61					64					62						61
DeMattia Flexometer (77° F.) (Flexes to Give ½-Inch Cut Growth)																				
Cures @ 287° F.	45′		60′			45′		60′			45′		60′			45′		60′		
Flexes @ R. T.	85,000		55,000			115,000		75,000			75,000		75,000			50,000		50,000		
After aging 24 hrs. (at 212° F.)	7,000		8,000			13,000		13,000			11,000		13,000			5,000		5,000		
Rebound																				
	Bashore		Healy			Bashore		Healy			Bashore		Healy			Bashore		Healy		
Cures @ 60 min.																				
% rebound	35		56.4			32		53.9			32		53.9			36		56.9		
Gehman-Temperature (to Give Angular Rotation of 20 Degrees)																				
Temp. °C.			—41					—43					—42					—49		
Vaporization Loss of Oil (from Open Container at 300° F.)																				
One hr.				3%					1%					1%						1%
Three hrs.				6%					2%					2%						3%

Type-Oil	Califlux GP					Sovaloid N					Sovaloid C					Phillips 9002				
Cures @ 287° F., min.	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75
Original Tested @ 82° F.																				
Tensile, p.s.i.	1230	3040	3220	3200	3340	690	2940	3060	3220	3100	1060	2460	2320	2320	2320	690	2200	2500	2600	2560
% elongation	965	765	690	640	635	890	840	670	630	595	520	480	410	400	400	625	650	515	490	430
Modulus @ 300%, p.s.i.	240	825	1080	1080	1210	195	600	910	980	1060	130	1060	1370	1480	1440	320	700	1190	1370	1520
Tear, p.s.i.	250	320	316	264	250	210	430	300	288	266	191	260	193	193	193	160	256	246	226	236
Durometer hardness	42	49	51	53	53	40	49	50	54	54	49	52	56	57	58	44	50	51	54	55
Original Tested @ 205° F.																				
Tensile, p.s.i.	800	1610	1660	1650	1480	420	1550	1480	1640	1090	795	1260	1160	1130	1060	510	1030	1240	1180	1200
% elongation	700	535	435	415	400	585	575	420	430	315	400	350	265	250	240	400	405	320	310	285
Modulus @ 300%, p.s.i	266	650	865	1000	998	210	615	830	930	1000	525	1050	....	....	....	354	730	1010	1080	....
Aged 48 Hrs. @ 212° F. Tested @ R. T.																				
Tensile, p.s.i.	2235	2580	2750	2595	2565	2570	2580	2685	2590	2710	2470	2630	2590	2620	2570	2335	2510	2325	2345	2245
% elongation	430	415	465	455	450	465	375	365	380	355	280	240	230	240	230	505	355	290	300	300
Modulus @ 300%, p.s.i.	1310	1730	1740	1600	1570	1370	2045	2195	2080	2060	....	....	....	....	....	1370	2080	....	2345	2245
Durometer hardness	59	60	60	60	60	65	69	70	70	70	80	82	82	82	84	65	70	71	71	71
Compounded Mooney (ML-4')																				
				58					62					86						72
DeMattia Flexometer (77° F.) (Flexes to Give ½-Inch Cut Growth)																				
Cures @ 287° F.	45′		60′			45′		60′			45′		60′			45′		60′		
Flexes @ R. T.	50,000		50,000			50,000		40,000			20,000		10,000			40,000		30,000		
After aging 24 hrs. (@ 212° F.)	11,000		14,000			5,000		7,000			1,000		1,000			3,000		3,000		
Rebound																				
	Bashore		Healy			Bashore		Healy			Bashore		Healy			Bashore		Healy		
Cures @ 60 min.																				
% rebound	33		56.4			39		57.5			44		61.0			41		60.0		
Gehman-Temperature (to Give Angular Rotation of 20 Degrees)																				
Temp. °C.			—42					—48					—53					—52		
Vaporization Loss of Oil (from Open Container @ 300° F.)																				
One hr.				4%					14%					29%						12%
Three hrs.				12%					31%					58%						37%

*ASTM D624-48.

at 212° F. The durometer value of the aged stocks increased only to about 60 from the original durometer values of about 54. All of these stocks before aging required more than 50,000 flexes for a half-inch cut growth on the DeMattia flexometer, and all of the stocks required more than 5,000 flexes after aging to give a half-inch cut growth.

Sovaloid N, reported to be about 80% aromatic hydrocarbons, gave good original and hot properties. However on the aging of this stock at 212° F. the durometer value increased from 54 to 70.

Sovaloid C, an entirely aromatic oil, gave slightly lower original and hot properties, and the durometer increased from 58 to 84 on aging 48 hours at 212° F. Sovaloid C gave a considerably tougher stock, as indicated by the CML-4′ value of 86. Flex-life of this stock was considerably below that of those stocks containing other petroleum oils mentioned above as only 20,000 flexes unaged and 1,000 flexes aged were required to give a cut growth of one-half inch. The aromatic-type oils would probably give better results if they had lower volatility.

Phillips 9002, an alkylated aromatic hydrocarbon, gave about equivalent properties to Sovaloid C although the

TABLE 12. RELATIONSHIP OF PROPERTIES OF RAW BUTADIENE-STYRENE POLYMERS WITH COMPOUNDED MOONEY VALUE OBTAINED WITH DIFFERENT AMOUNTS OF OIL AND CARBON BLACK

Polymer No.	Parts MTM Modifier	Crude Mooney Viscosity	% Gel	Swelling Index	Solution Intrinsic Viscosity	Compound No.	Parts Oil	Parts HAF Carbon Black	Compounded Mooney Viscosity
226	0.0	156*	58	37	2.04	226A	45	72.5	126*
						226R	75	87.5	98
						226BR	90	95	78
						226C	110	105	53
230	0.05	164*	25	139	3.49	230A	40	70	140*
						230R	70	85	77
						230C	80	90	64
						230BR	90	95	53
227	0.10	164*	1	..	3.60	227A	30	65	142*
						227C	45	72.5	76
						227R	60	80	62
						227BR	80	90	48
252	0.125	121	0	..	3.00	252A	25	62.5	84
						252	40	70	65
						252B	55	77.5	50
228	0.15	98	0	..	2.79	228A	25	62.5	73
						228C	35	67.5	54
						228R	50	75	45
						228BR	70	85	35
251	0.175	93	0	..	2.52	251A	15	57.5	79
						251	30	65	66
						251B	45	72.5	40
235	0.20	90	0	..	2.44	235A	10	55	77
						235C	20	60	70
						235	30	65	49
						235BR	50	75	37
249	0.225	56	0	..	2.06	249	5	52.5	69
						249A	30	65	49
234	0.25	51	0	..	2.00	234B	0	50	72
						234	5	52.5	64
						234A	30	67	40
GR-S X-478	..	59	0	..	1.91	X478A	5	52.5	74
						X478B	15	57.5	62
						X478C	30	65	46

*Tore on Mooney machine.

TABLE 13. STRESS-STRAIN DATA FOR COMPOUNDS USED TO INVESTIGATE RELATIONSHIP OF PLASTICIZER RATIO AND MOONEY VISCOSITY

Compound No.	226A					226R					226BR					226C				
Parts carbon black	72.5					87.5					95					105				
Parts oil	45					75					90					110				
Cure @ 287° F., min.	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75
	Original Tested @ R. T.																			
Tensile, p.s.i.	1870	2150	2160	1950	2020	2080	2900	2900	2870	3140	1650	2560	2680	2660	2660	905	2280	2260	2400	2420
% elongation	330	250	200	200	200	785	625	525	475	550	825	605	550	500	480	940	730	665	570	550
Modulus @ 300%, p.s.i.	1650	....	....	....	....	510	900	1260	1420	1390	276	900	1130	1160	1240	206	600	680	900	980
Tear, p.s.i.	264	214	197	236	190	326	300	286	272	282	306	290	288	290	314	224	276	270	260	214
Durometer hardness	64	67	65	66	70	47	52	54	55	55	41	49	50	51	51	36	45	46	48	49
	Compounded Mooney Visosity (ML-4')																			
					129					98					73					53

Compound No.	230A					230R					230C					230BR				
Parts carbon black	70					85					90					95				
Parts oil	40					70					80					90				
Cure @ 287° F., min.	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75
	Original Tested @ R. T.																			
Tensile, p.s.i.	1940	3060	3060	2680	2740	910	2620	2880	2880	2820	415	2420	2680	2600	2740	780	2400	2580	2640	2580
% elongation	530	400	340	325	315	900	700	600	550	555	825	715	645	500	540	1000	705	605	575	535
Modulus @ 300%, p.s.i.	1060	2000	2260	2360	2460	133	650	1060	1160	1140	130	690	980	1190	1160	111	680	840	1080	1100
Tear, p.s.i.	324	274	232	216	228	254	354	322	286	302	131	292	266	276	244	212	330	338	278	320
Durometer hardness	56	60	61	62	65	54	59	63	63	63	38	48	50	51	52	36	46	49	50	50
	Compounded Mooney Viscosity (ML-4')																			
					140					77					64					53

Compound No.	227A					227C					227R					227BR				
Parts carbon black	65					72.5					80					90				
Parts oil	30					45					60					80				
Cure @ 287° F., min.	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75
	Original Tested @ R. T.																			
Tensile, p.s.i.	2160	2780	2850	2520	2700	430	3100	3300	2780	3100	1290	2600	2860	2750	2780	1090	2460	2600	2580	2620
% elongation	500	365	330	300	300	875	680	595	475	475	900	675	575	565	550	950	600	500	575	530
Modulus @ 300%, p.s.i.	1140	2360	2650	....	....	100	1080	1340	1550	1630	195	695	1110	1200	1220	153	720	1000	1060	1130
Tear, p.s.i.	340	302	208	224	228	135	306	270	328	290	320	324	306	292	256	236	330	290	276	228
Durometer hardness	60	65	68	68	68	47	55	58	59	60	46	52	54	55	55	39	48	49	50	51
	Compounded Mooney Viscosity (ML-4')																			
				142					76					62					48	

Compound No.	252A					252			252B				
Parts carbon black	62.5					70			77.5				
Parts oil	25					40			55				
Cure @ 287° F., min.	15	30	45	60	75	30	45	60	15	30	45	60	75
	Original Tested @ R.T.												
Tensile, p.s.i.	920	3340	3420	3400	3260	2680	3040	3020	110	1880	2190	2320	2300
% elongation	925	650	550	500	480	700	630	510	1050	750	610	550	510
Modulus @ 300%, p.s.i.	216	1290	1500	1760	1980	690	1030	1280	50	505	740	1050	1080
Tear, p.s.i.	304	376	415	382	338	450	374	342	66	350	322	296	330
Durometer hardness	50	58	61	61	61	55	56	58	40	49	50	53	54
	Compounded Mooney Viscosity (ML-4')												
			84				65				50		

TABLE 13 (CONT'D)

Compound No.	228A					228C					228R					228BR				
Parts carbon black	62.5					67.5					75					85				
Parts oil	25					35					50					70				
Cure @ 287° F. min.	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75
Original Tested @ R. T.																				
Tensile, p.s.i.	920	3240	3380	3200	3300	590	2620	2860	2920	2960	880	2580	2680	2740	2640	330	2020	2300	2260	2340
% elongation	775	550	500	435	450	1050	730	610	580	540	925	750	575	550	550	1125	700	650	600	580
Modulus @ 300%, p.s.i.	308	1310	1830	1970	1960	340	730	1220	1250	1340	182	760	1130	1200	1150	55	530	790	900	935
Tear, p.s.i.	230	356	310	346	274	65	398	350	306	300	236	378	348	400	330	106	358	370	370	236
Durometer hardness	50	59	61	62	62	45	55	56	59	59	45	54	55	55	55	36	46	48	50	50
Compounded Mooney Viscosity (ML-4')																				
				75					54					45						35

Compound No.	251A					251			251B				
Parts carbon black	57.5					65			72.5				
Parts oil	15					30			45				
Cure @ 287° F. min.	15	30	45	60	75	30	45	60	15	30	45	60	75
Original Tested @ R.T.													
Tensile, p.s.i.	1040	3200	3560	3600	3560	2840	3100	3080	214	2080	2680	2580	2780
% elongation	850	685	580	525	500	670	595	520	910	750	680	600	570
Modulus @ 300%, p.s.i.	250	1130	1380	1540	1900	930	1260	1570	106	610	895	1080	1100
Tear, p.s.i.	266	430	320	314	356	400	340	405	53	392	370	366	312
Durometer hardness	51	58	60	62	63	58	60	61	44	52	55	57	58
Compounded Mooney Viscosity (ML-4')													
			79				66				40		

Compound No.	235A					235C					235					235BR				
Parts carbon black	55					60					65					75				
Parts oil	10					20					30					50				
Cure @ 287° F. min.	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75
Original Tested @ R. T.																				
Tensile, p.s.i.	2060	3260	3200	3400	3040	160	2400	2950	3180	3320	433	2560	2900	2760	2800	1410	2440	2400	2540	2460
% elongation	660	425	330	330	325	1025	715	620	540	550	965	735	620	500	510	900	550	475	475	450
Modulus @ 300%, p.s.i	605	2140	2620	2680	2680	108	805	1070	1500	1420	216	725	1140	1320	1340	270	1050	1240	1330	1390
Tear, p.s.i.	470	292	240	268	266	63	405	362	318	282	135	376	300	338	298	304	368	296	270	276
Durometer hardness	58	66	67	68	68	46	58	59	61	62	48	55	59	60	60	46	54	56	57	57
Compounded Mooney Viscosity (ML-4')																				
				77					70					49					37	

Compound No.	249			249A					GR-S X-478A					GR-S X-478B				GR-S X-478C			
Parts carbon black	52.5			65					52.5					57.5				65			
Parts oil	5			30					5					15				30			
Cure @ 287° F. min.	30	45	60	15	30	45	60	75	15	30	45	60	90	30	45	60	90	30	45	60	90
Original Tested @ R.T.																					
Tensile, p.s.i.	3180	3520	3200	108	2140	2580	2760	2780	396	3260	3400	3200	2760	2860	3020	3200	2980	1930	2260	2940	2720
% elongation	665	605	505	1150	800	685	655	590	825	562	467	412	387	575	537	500	452	715	630	562	532
Modulus @ 300%, p.s.i.	1050	1390	1450	54	550	850	900	1020	264	1540	1960	2100	2120	1260	1440	1950	1920	660	950	1240	1390
Tear, p.s.i.	460	430	342	61	352	400	352	360	...	...	...	...	...	...	...	...	...	...	...	...	...
Durometer hardness	62	65	65	41	50	52	55	55	58	64	66	67	68	61	63	64	64	56	58	60	60
Compounded Mooney Viscosity (ML-4')																					
		69			49					74					62				46		

Compound No.	234B				234					234A				
Parts carbon black	50				52.5					67				
Parts oil	0				5					30				
Cure @ 287° F. min.	30	45	60	75	15	30	45	60	75	15	30	45	60	75
Original Tested @ R.T.														
Tensile, p.s.i.	3520	2240	3200	3120	515	3240	3560	3360	3820	298	1910	2550	2680	2800
% elongation	400	225	320	335	1100	675	550	495	470	1110	835	650	650	615
Modulus @ 300% p.s. .	2460	....	2800	2850	150	1380	1840	2100	2300	118	540	800	1130	1250
Tear, p.s.i.	430	282	280	220	182	440	378	342	338	45	350	376	334	328
Durometer hardness	65	67	68	70	52	64	66	68	68	47	54	56	59	59
Compounded Mooney Viscosity (ML-4')														
			72				64					40		

Compound No.	339A					339B					339C				
Parts carbon black	70					77.5					85				
Parts oil	40					55					70				
Cure @ 287° F. min.	15	30	45	60	75	15	30	45	60	75	15	30	45	60	75
Original Tested @ R.T.															
Tensile, p.s.i.	1760	2230	2340	2300	2240	1060	2160	2260	2240	2240	580	1670	1930	2200	2080
% elongation	575	490	400	400	390	600	530	500	490	475	700	600	575	550	500
Modulus @ 300%, p.s.i.	735	1230	1640	1640	1620	375	930	1100	1260	1240	320	620	925	1080	1000
Durometer hardness	56	59	60	60	61	49	50	51	55	55	45	50	50	54	55
Compounded Mooney Viscosity (ML-4')															
			81				64					47			

stock did not increase in hardness so much, increasing in durometer from 55 to 71 on aging. It also gave slightly better flex results than Solvaloid C.

Low-temperature properties of these plasticized high Mooney viscosity polymers were found to depend on the particular oil used. The temperature required to give an angular twist of 20 degrees in a Gehman apparatus was chosen for comparison.[3] The GR-S control gave an an-

[3] S. D. Gehman, D. E. Woodford, C. S. Wilkinson, Jr., *Ind. Eng. Chem.*, 39, 1108 (1947).

gular twist of 20 degrees at —45° C. Stocks plasticized with 60 parts of either Circosol 2XH or Sundex 53 gave similar angular twists at —49° and —41° C. respectively. In the judging of the suitability of a particular oil as a plasticizer, overall consideration should include the compatability, volatility, and low-temperature characteristics.

Relationship between Oil Loading and Mooney Value

An intensive study was made of a series of butadiene-styrene copolymers prepared at a charging ratio of 72/28 at 41° F. and carried to 72% conversion. These polymers were made to different degrees of toughness by varying the amount of MTM modifier used. The raw polymers were characterized by Mooney data and sol-gel determinations. Each of the polymers was compounded with at least three ratios of Sundex 53 and HAF carbon black. Compounded Mooney viscosities were obtained as a measure of processability, and physical properties were measured on the vulcanized stocks.

Table 12 shows the parts of MTM used, the ML-4' value of the crude polymer, % gel, swelling index (S.I.) and intrinsic viscosity [η] of the soluble portion of the rubber. In addition the ratios of oil and black used are given with each polymer in the series and also the compounded Mooney viscosities.

The toughest polymer (No. 226) was prepared in the absence of modifier, and was found to contain 58% gel having a swelling index of 37, indicating a fairly tight gel structure. The next polymer in the series (No. 230) was prepared with 0.05-part MTM and had 25% gel with a swelling index of 139, which indicates a lower degree of toughness than the unmodified polymer. The polymer prepared with 0.1-part of MTM (No. 227) had only 1% gel and had an intrinsic viscosity [η] value of 3.6. The remainder of the polymers in this series was gel free. As the amount of MTM modifier was increased, it can be seen that lower [η] values were obtained. Data from Table 12 were originally used to construct Figures 1, 2, and 3, from which one can predict fairly reliably the amount of oil and black required to give a compounded Mooney of 60.

Table 13 shows complete stress-strain data for compounds listed in Table 12. In Table 13 the physical properties of polymer 226 are seen to vary with the oil-carbon black ratio used. By using only 45 parts of oil and 72.5 parts of carbon black, a tough processing stock having a compounded Mooney viscosity of 129 was obtained. Tensile and elongation were at a low level, and the durometer was high. At this low level of plasticizer, the carbon black is not adequately dispersed or wetted. With 75 parts of oil a fairly good stock was obtained, but the level would still be too high to handle readily in factory equipment. A loading of 90 parts of plasticizer gave a good balance of cured properties and would be nearly optimum for factory handling. The highest loading of plasticizer, 110 parts, gave slightly too soft a stock for tread applications. The best balance of physical properties with suitable processability is obtained at about 100 parts of plasticizer.

Also shown in Table 13 are results on a 72/28 butadiene/styrene rubber (No. 339) prepared at 122° F. to 70% conversion employing 0.18-part of MTM modifier. This polymer has a "computed" Mooney of 150. The data illustrate that an optimum oil loading of 58 parts is indicated to balance processability and physical properties for this 122° F. polymer.

In a similar manner the proper oil loading for the other polymers can be derived from Table 13. In Table 14 are listed these optimum loadings. All of these stocks at optimum oil loading show tensile values in excess of 2500 p.s.i. with elongations over 500% and good tear strength. It is of particular interest that even those polymers (226 and 230) with high gel content can be plasticized with oil to give processable stocks with excellent physical properties.

Table 14. Indicated Optimum Oil Loadings for Butadiene-Styrene Polymers at Different Raw Mooney Levels to Give 60 Compounded Mooney Viscosity

Polymer No.	Crude Mooney Viscosity	"Computed" Mooney Viscosity	Indicated Optimum Loading of Sundex 53
226	156*	250	100
230	164*	212	84
227	164*	162	62
228	98	106	37
251	93	91	30
235	90	80	24
249	56	61	16
234	51	48	9
GR-S X-478	59	62	17

* Tore in Mooney machine.

Comparison of Tread Stocks

In Table 15 is shown a comparison of the physical properties of a tread stock made from an oil-plasticized high Mooney viscosity synthetic rubber (A) and a regular cold rubber (GR-S X 598) (B). The high-viscosity rubber was compounded with 50 parts of Sundex 53 and 75 parts of HAF carbon black based on 100 parts of polymer. The raw Mooney viscosity of the polymer was 130.

Copolymers of Butadiene with Various Vinyl Monomers

That the use of oil to plasticize high-viscosity polymers

Table 15. Comparison of the Physical Properties of Tread Stocks Made from Plasticized High-Viscosity Polymer (A) and 41° F. GR-S X-598 (B).

	Cure Time Min.	300% Modulus, P.S.I. A	300% Modulus, P.S.I. B	Tensile, P.S.I. A	Tensile, P.S.I. B	Elongation % A	Elongation % B	Tear, P.S.I. A	Tear, P.S.I. B	Durometer Hardness A	Durometer Hardness B
Original Tested @ 77° F.	15	250	420	1200	1490	850	880	190	260	47	55
	30	1140	1190	2850	2940	650	620	395	415	56	62
	45	1370	1410	3100	3215	600	560	382	384	59	65
	60	1420	1460	3210	3200	560	530	396	390	59	65
	90	1480	1520	3190	3145	540	510	350	365	60	66
Aged 48 Hrs. at 212° F.	15	2400	....	2700	2275	330	300	....	....	65	74
	30	2425	....	2950	2400	360	250	....	....	68	74
	45	2400	....	2850	2500	330	280	....	....	67	74
	60	2300	....	3075	2375	380	280	....	....	67	73

A	B
Compounded Mooney Viscosity	
65	64
DeMattia Flexing (77°F) (To Give ½-Inch Cut Growth)	
45,000	47,000

	A	B
Goodrich Flexometer (Starting Temperature 212° F.)		
△T, °F.	40°	51°
Permanent Set	8.9%	11.2%
Bashore Rebound		
77° F.	37	42
212° F.	53	50

TABLE 16. STRESS-STRAIN DATA FOR COMPOUNDS PREPARED FROM HIGH MOLECULAR WEIGHT COPOLYMERS OF BUTADIENE AND VARIOUS VINYL COMONOMERS

Comonomer	Mooney Viscosity Initial	Mooney Viscosity 4′	Parts Oil†	Parts HAF Black	Compounded Mooney Viscosity	Cure Min.	300% Modulus, P.S.I.	Tensile, P.S.I.	Elongation %	Durometer Hardness
Methyl methacrylate	195	153*	50	75	61	60	1150	3000	555	54
	169	148*	40	70	55	90	1490	3320	520	56
3, 4 Dichloro △methyl styrene	198	165*	50	75	57	90	1240	2900	580	57
	146	131	40	70	53	60	1165	2840	565	57
Methyl isopropenyl ketone	187	148*	55	75	47	60	1380	3095	565	60
	166	135*	45	70	56	30	1500	3010	515	60

* Tore in Mooney machine.
† Sundex 53.

TABLE 17. COMPOSITION AND STRESS-STRAIN PROPERTIES OF SOME MECHANICAL GOODS STOCKS USING PLASTICIZED HIGH MOONEY VISCOSITY SYNTHETIC RUBBER

Parts Rubber	Parts Plasticizer	Parts Pigment	Cure Min.	Modulus 300% P.S.I.	Tensile P.S.I.	% Elongation	Tear P.S.I.	Durometer Hardness
100	60 Sundex 53	80 Indulin A[1]	60	600	3130	900	450	83
100	70 Sundex 53	100 Indulin A	60	580	2790	940	375	70
100	60 Circosol 2XH	60 Hi Sil[2]	20	450	1700	550	170	50
100	100 Sundex 53	200 Statex 93[3]	60	1190	1570	465	250	54
100	40 Sundex 53 30 Mineral Rubber 20 Resinex R100	50 Philback[4] 100 Hard clay[5]	45	830	1550	650	...	69
100	100 Sundex 53	300 Soft clay[6] 75 Calcene T[7]	3*	...	770	290	158	63
			5*	...	890	255	152	63
			10*	...	880	245	145	64
100	100 Sundex 53	310 Soft clay 110 Whiting[8]	3*	615	755	315	145	60
			5*	685	705	305	138	60
			10*	710	760	310	132	61

*These cures at 320° F.; all others at 287° F.
SUPPLIERS:
[1] West Virginia Pulp & Paper Co.
[2] Columbia Chemical Division, Pittsburgh Plate Glass Co.
[3] Columbian Carbon Co.
[4] Phillips Chemical Co.
[5] J. M. Huber Co.
[6] Akron Chemical Co.
[7] Columbia Chemical Division.
[8] Piqua Stone Co.
NOTE: Stocks for compounds containing Indulin A were prepared by coprecipitating the synthetic rubber, oil, and lignin.

to produce compounds having good physical properties is not limited to butadiene-styrene copolymers can be seen from the data in Table 16. The synthetic rubbers used for these experiments were all made with a charge ratio of 75 parts of butadiene and 25 parts of the vinyl monomer. Two copolymers with different Mooney viscosity values were made from each of the vinyl monomers. The polymerizations were run at 41° F. and stopped at 72% conversion. The compounds were all dry mixed in a Banbury mixer. The stress-strain data are for compounds at optimum cure.

Some Mechanical Goods Compounds

Plasticized high Mooney viscosity rubbers can be used very satisfactorily in mechanical goods to make low-cost compounds having adequate physical properties for many applications. To illustrate this versatility, a few such compounds are assembled in Table 17 along with their stress-strain data.

Conclusion

The data which have been presented show that extremely high Mooney viscosity synthetic rubbers, previously considered unusable by the rubber industry, may be combined with certain softeners to give stocks of excellent quality. These stocks were found suitable even for high-quality items, such as tires, as well as for low-cost mechanical goods. Surprisingly enough, even high-viscosity synthetic rubbers containing large amounts of a tightly bound gel can be plasticized with large amounts of oil to give high-quality stocks which are processable. To realize the maximum physical properties obtainable from high Mooney viscosity rubbers and have compounds which will handle satisfactorily in the usual rubber machinery, there is an optimum amount of plasticizer for each polymer of different viscosity level. For compounding purposes the pigment loading necessary to give the desired physical properties is best obtained by considering the rubber-plasticizer mixture to be 100% rubber hydrocarbon.

Tire treads using this process and made on conventional tire machinery in the factory have received excellent road test ratings. More than a year's background on tire testing both in hot and cold weather has substantiated the merit of this unique development. These data as well as factory processing data will be presented in a forthcoming paper in cooperation with Polymer Corp., Ltd., Sarnia, Ont., at the June 15, 1951, meeting of the Division of Rubber Chemistry of the Canadian Institute of Chemists, at Kitchener, Ont. Plasticized high Mooney viscosity polymers of the type described in this paper are currently being made experimentally by Polymer Corp.

The general adoption of this development would result in substantial benefits to both the public and the rubber industry. The increased amount of finished stock which results from the use of plasticized high-viscosity rubber would alleviate the synthetic rubber shortage. The need of constructing new GR-S plants should be reconsidered. Expensive butadiene derived from alcohol would not be required. Some of the butadiene and the styrene and other ingredients now used in the present method of manufacture of synthetic rubber could be diverted to other critical uses. Products could be made at a lower total cost than from GR-S. The use of this development would result in an ultimate saving for the American people. The synthetic rubber industry would thus be assured a much better economic position in relation to the natural rubber industry even though the price of the natural product were to be greatly reduced.

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A Review of the Mechanism of Flex-Cracking and Flex-Cracking Tests—I

J. M. Buist[1] and G. E. Williams[1]

FLEX-CRACKING causes the failure of many rubber articles in service, but the mechanism of flex-cracking is not clearly understood; therefore complete agreement on the best methods of protecting compounds and also for testing compounds is not always easy to attain. The subject of flex-cracking was raised at the 1949 meeting of International Organization for Standardization, Technical Committee 45—Rubber, at the Hague, Holland, and it was suggested that before progress could be made the information in the literature should be reviewed. The present authors undertook this work on behalf of the United Kingdom delegation, and in addition to covering published work it was possible to include unpublished information, and this cooperation from several sources is gratefully acknowledged. At the 1950 ISO/TC/45 meeting in Akron, O., all delegations were in substantial agreement with the views expressed in the review; therefore this paper is published in the hope that it will stimulate experimental work to fill in the gaps in our knowledge in this difficult field.

In the present review the subject, extremely diffuse and complex, has been divided into the following subsections, but it is emphasized that these sections are highly interrelated, and the dividing lines are quite artificial.

Definition of terms.

Mechanism of crack initiation and cut growth.

Service conditions and methods of test.

Methods of rating and errors of test.

Effect of modification of the test environment, test conditions, and method of sample preparation.

Relation with other tests.

Discussion of du Pont, DeMattia, Flipper, and Vogt machines.

Definition of Terms

In an attempt to avoid ambiguity the meanings of certain words are given below. They are only provisional working definitions and may need to be altered as a result of discussion and as our knowledge increases.

FLEX-CRACKING is the occurrence and growth of cracks in the surface of rubber when repeatedly submitted to a cycle of deformation. This phenomenon occurs in the sidewalls of tires and in the base of grooves in the tread.

Flex-cracking tests must be distinguished from fatigue flexing tests, in which the breakdown is of a different type as in the detrition machine and the Goodrich and Fire-stone flexometers. These so-called "flexometers" are really compression-fatigue machines.

In the process of flex-cracking, two stages are recognized: *crack initiation*, the period up to the point where cracks are first apparent; *crack growth*, the stage where cracks, already initiated, become larger until ultimately the sample may fail by breaking.

Mechanism of Crack Initiation and Crack Growth

The dividing line between crack initiation and crack growth is quite arbitrary and depends on the criterion by which cracking is judged to be apparent. It is usual to judge the appearance of cracks visually, but if a microscope were used, the cracks would be apparent at an earlier stage.

Cracks may be initiated by means other than flexing, e.g., by exposure to ozone or to light and air.

Crack growth takes place when a tire is cut by a flint or by abrasion, or follows initiation due to flexing the cut growing under the influence of repeated deformations. The crack is initiated in tests by the deliberate introduction of a standard cut, and the subsequent behavior corresponds to crack growth.

Fatigue is the change in physical structure and properties of the mass of a piece of rubber subjected to repeated deformations. These structural changes may result in cracks on a sub-microscopic scale, which grow steadily throughout flexing. If this is so, a question arises as to why flex-cracks always seem to begin from the surface. The precise questions raised here are:

Do flex-cracks *always* begin on the surface?

If so, is this because of oxidation, which may be more vigorous on the surface, or because the strain is always greatest on the surface?

In practice, it is not possible to eliminate chemical agencies, such as oxidation, from causing changes in physical structure and properties, but ideally, in measuring fatigue, chemical agencies should be eliminated so that repeated deformation is the sole cause of change.

Two main agencies may now be enumerated as playing a part in flex-cracking: fatigue; oxidation (including attack by ozone).

Obviously their relative importance in any application depends on the particular material and conditions.

(A) As fatigue occurs under repeated stressing, it undoubtedly plays some part in the process of flex-cracking. The exact contribution from fatigue is difficult to determine. Most authors have very reasonably compared fatigue results with those of many other properties. This approach has been used by Behre (1),[2] Cassie, Jones and Naunton (2), Naunton and Waring (3-4), Cadwell, Merrill, Sloman, and Yost (5), and Juve (6). Although important conclusions, such as fatigue life showing a minimum value when the test piece is allowed to pass through zero strain, have been reached, it is fair to say that the mechanism of fatigue is not understood clearly. The internal friction of the rubber is an important factor which has been studied, but the main difficulties seem to be in devising methods of measuring the internal friction and insuring that the internal friction has the same value throughout the rubber.

[1] Imperial Chemical Industries, Ltd., Manchester, England.

[2] Numbers in parentheses refer to Bibliography items at the end of this installment.

Some tests have confused true flex-cracking, which proceeds from the surface and occurs at room temperature, with the fatigue failure which results from overheating and in which deterioration of the rubber develops inside first and then proceeds outward; thus the term "flexing-fatigue test" is an ambiguous one which should be restricted to service tests in which flex-cracking and heat build-up are deliberately combined.

(B) The mechanism of flex-cracking phenomena is not understood. There have been suggestions that ozone or oxygen play a part, or that progressive tearing of the rubber takes place, and the phenomenon is physical and not chemical. It is thus extremely difficult to define what conditions should be kept constant and to predict the results of small changes in the existing conditions, especially as remarkably little work has been done on varying the specification limits. A brief summary (7) of the position has been published. Similarly, the mechanism of crack initiation is not understood, and there are theories that either physical (cutting or stress-relaxation) or chemical (ozone or oxidation) effects are involved. The former would be much influenced by such accidental things as scratches in the mold cover plate, the presence of included grit, or chance abrasion of the molded rubber surface. The latter would be influenced by various environmental conditions which have not at present been considered in framing specifications. These difficulties have been specially pronounced in the case of GR-S, where it was found that crack-initiation was so variable that it was necessary to make small cuts and measure the rate of crack-growth. It is possible, therefore, that there would be a better chance to standardize crack-growth tests than flex-cracking tests.

The present position can best be summarized by saying that both fatigue and oxidation phenomena contribute toward flex-cracking. In other words, any separation of flex-cracking into chemical or physical processes must of necessity be artificial as it is most likely that both chemical and physical agencies affect crack initiation and crack growth. The relative importance of the chemical and the physical factors may be quite different in the case of crack initiation, which makes further detailed experimental work essential if real progress in elucidating the mechanism of flex-cracking is to be made. An attempt is therefore made in the later sections of this report to summarize previous work reported in the literature.

Service Conditions and Methods of Test

Flex-cracking is important as it can be a cause of failure in the sidewalls and the base of tread grooves in tires, in belts, and other applications.

With natural rubber it has been stated (see later) that the upper limit to the amount of black which can be used in tire treads is set by the increased tendency to flex-cracking with higher loadings. If flex-cracking could be reduced, higher black loadings would be possible, with a possible resultant improvement in abrasion resistance.

The poor flex-cracking resistance of GR-S compared with natural rubber is one of its major disalvantages in uses such as tires.

Service Conditions

Cooper (8) states that a normally inflated tire is under less than 5% elongation; while some parts may be elongated to possibly 10% as the tire rotates under load.

Since the rigidity is due chiefly to the carcass fabric, the conditions of operation are almost independent of the stress-strain properties of the stock.

Naunton and Waring (4) state that flexing is of the constant deformation type in belts, and constant load in tires. In certain parts of tires where flex-cracking takes place, the flexing may be nearly of the constant deformation type.

Many service tests, in which the causes of failure of an article in service are accentuated, involve flexing; they comprise such diverse tests as those on actual tires reported by Gray, Karch, and Hull (9) and tests for hydraulic brake hose reported by Carpenter (10), which it is not proposed to report in detail here.

Methods of Test

Flex-cracking tests may be classified into three groups according to the type of strain: repeated linear extension; repeated bending without tension; combination of extension and bending. A brief summary of the tests follows.

Repeated Linear Extension

Dynamometer P-B. Memmler (11) states that this combination tester, invented by Pierre Breuil, was the first machine for testing repeated stresses. A sample is stretched and relaxed by means of a hand or motor-operated screw, and tension read by means of a spring balance.

Martens-Schopper. This "fatigue" testing machine is also described by Memmler (12). It simultaneously stretches and releases four rings. The tension is controlled by means of springs, and the ring travels over rollers during the test.

Firestone. This test is described by Cooper (8). Dumbbells are extended by oscillating grips. Cooper states that the usual elongation is 0-100% at 400 flexes/min. (=35-40 m.p.h. in a tire), and under these conditions a tread stock lasts eight hours. This test was also used by Street (13).

Vogt. A strip of rubber with a hole in the center is repeatedly stretched. This is the rocker fatigue machine used by Cassie, Jones, and Naunton (2) and modified to show the increase of life when a sample is not allowed to relax to zero strain.

DeMattia. The DeMattia machine can be used for elongating dumbbells (ASTM D-430), in which case it is similar to the Firestone machine.

Repeated Bending without Tension

India Tire & Rubber Co. This was first described by Torrance and Peterson (14). A rotor disk one inch thick is keyed to the shaft of a motor and radially slotted round the periphery to take 12 samples. Round this is a steel ring placed off-center in relation to the rotor. Test samples are molded strips with two grooves; one takes a pin for holding to the rotor, and the other serves to localize the bending. Samples are flexed through 90 degrees, when the ring is closest to the rotor, and straighten out at the opposite side by elasticity and centrifugal force. The motor runs at 1,725 r.p.m., and to reduce friction, samples are lubricated with glycerine by a wick feed.

R.S.L. Machine (Rubber Service Laboratories). The Torrance-Peterson machine was modified by Booth (15) so that the samples were bent by contact with an idler pulley. The R.S.L. machine, described by Crawford (16), consisted of four disks arranged so that samples on the periphery bent against idler wheels.

Monsanto Flipper. This is very similar to the R.S.L. machine. But there are only two disks, holding 18 samples each.

DeMattia. The DeMattia machine was modified by Rainier and Gerke (17) so as to flex samples through a predetermined angle. This test has been used by Somerville (18), Breckley (19), Carlton and Reinbold (20), Schwarz (21), and Newton (22). A photograph of the National Rubber Machinery Co.'s Model D is reproduced in many places, including ASTM 1950 Standards on Rubber Products, D-430-49 T (b).

Vibration Machine. A machine which vibrates a sheet of rubber has been described by Saito and Ishiguro (23), which, though not strictly a flex-cracking test, has been used to measure changes in the physical properties of the rubber after vibration.

Graffe. This machine (24) bends a strip of rubber with one end fixed, by means of an oscillating arm.

Combination of Extension and Bending

Goodyear Punched Strip. This was described in the "Vanderbilt Handbook, 1936." A strip of rubber has three holes punched in it. The outer holes fit into grips, and the hole at the center concentrates the stresses. It is thus similar to the Vogt machine, except that the sample is stretched to 60% elongation and then bent to about 45% of its original length.

Du Pont. Designed at the Fisk Rubber Co., this later was developed and improved by du Pont. An enclosed machine of this type was used by Neal and Northam (25). Carlton and Reinbold (20) have used this machine with GR-S. This machine has been used for flex-cracking and ply separation tests, but it is generally considered unsuitable for the latter tests.

A recent modification (26) in which the straight balance arm is replaced by a bent arm of suitable design has been incorporated in the revised edition of B.S. 903 (1949), and it is understood that this modification has been included in the latest draft of ASTM D-430. This insures a constant belt tension throughout the test.

Scott Pulley-Bend Test. This is primarily a ply separation test in which strips of plied rubber and fabric are reciprocated over idler pulleys (see ASTM D-430-40).

Pirelli. This is described by Eccher (27). A rubber ring, vulcanized in a press, is mounted between two pulleys, one of which is driven, and the other idles. The distance between them is variable.

Methods of Rating and Errors of Test

Most authors are agreed that taking the number of flexes to break gives very variable results, especially since some samples which crack quickly at first manage to survive a long time before finally breaking. Recent work (28) suggests a very large variation exists at the initiation stage, and this large variation is present throughout the growth stage. It would therefore be important to reduce the errors at the initiation stage.

Methods of Rating

Rainier and Gerke (17) measured the bending moment after flexing and expressed it as a percentage of the original bending moment. They found that the percentage loss of bending moment was almost proportional to depth of crack and was in linear relation with the number of flexes, over the range 15-60% loss in bending moment. Results were given as the number of kilocycles of flexing required to produce a fall of 1% (based on the original bending moment) in the bending moment. This measure was therefore constant over the major portion of crack growth and indicated resistance to crack growth.

Vogt (29) stated that this was the only mathematical expression for flex-cracking in the literature. Rainier and Gerke's paper is the only one giving an analysis of the error of test using a specified compound on a specified machine. They claim that differences of 6% are significant using 0-60-degree bend, and 35% using 0-20-degree or 0-30-degree bend. This point must be related to the differences actually obtained between different compounds, which on their test are commonly 60%, but can be as much as 500%.

A set of numbered photographs or standard samples has been used by many authors. Neal and Northam (25) used 0-8; while ASTM D-430-35T suggested 0-10, and most authors have used the latter. The necessity of equalizing the spacings of a series of standards by statistical means has been pointed out by Newton (22) [see also Stevens (30) who suggested the use of a logarithmic scale for number of flexes]. Newton's scale is from 0-10 and has been incorporated in B.S.903, 1950. Another scale has also been published (31).

Blackwell (32) has found that with cut-growth data when the length of cut (y) is plotted against log kcs. (x), the curves followed a shape of the form

$$y = a/(b + x)^2$$

This means that the Newton "scoring" method, given in B.S.903, can be applied to cut-growth data. In his work Blackwell used "scores" corresponding to cut lengths of 0.1-inch, 0.13-inch, 0.19-inch, 0.30-inch, and 0.50-inch; the standard grade was equivalent to a cut length of 0.19-inch.

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(To be continued)

"Thiovanic Acid, Vacuum Distilled Thioglycolic Acid." Evans Chemetics, Inc., New York 17, N. Y. 4 pages. This bulletin covers composition, properties, specifications, typical reactions, suggested uses, and availability of Evans vacuum distilled thioglycolic acid. Suggested applications include use in rubber reclaiming, antioxidants, and polymerization modifiers.

Editorials

The Possible World Rubber Surplus and Its Effect on Industry Controls

WE WOULD like to develop further some thoughts expressed on this page last month, which subsequent events have shown may be possible of realization sooner than expected, that is, there will be a world rubber surplus in 1951 accompanied by lower prices and a reduced need of international and national controls on rubber, barring all-out war.

The idea of a world surplus of rubber in 1951 has been confirmed by no less eminent authority than the International Rubber Study Group, which at the end of its April, Rome meeting suggested that the difference between estimated world production and consumption of both natural and synthetic rubbers in 1951 would leave 360,000 long tons for "absorption into governmental and commercial stocks."

James J. Newman, vice president, B. F. Goodrich Co., on his return from the Rome meetings said he thought the Study Group estimates of world consumption were too liberal and based on very high shipments to Iron Curtain countries since Korea. His company estimated that world consumption in 1951 would leave a surplus of 500,000 tons.

The Goodrich estimate does seem more reasonable, particularly in view of the long overdue action of the British Government on May 10 in barring further shipments of natural rubber to Communist China. A considerable price drop in London and Singapore markets followed this British action, and it was also revealed that there were 50,000 tons of rubber that would be stockpiled by England instead of going to China.

A change from a seller's to a buyer's market in rubber, if it does occur in 1951, would have far-reaching effects both in this country and abroad. In addition to the pronounced trend toward lower prices for natural rubber which has already taken place, government stockpiles would be accumulated sooner and might be smaller in size. In the United States, exclusive buying of rubber by the government might be terminated sooner.

The need of the present degree of restriction on the consumption of natural rubber by American rubber goods manufacturers would be eliminated, and with the very considerable increase in synthetic rubber availability due by this summer, restrictions on total new rubber use might likewise become unnecessary.

The Senate Small Business subcommittee on rubber has been asked by its industry advisory committee to have the National Production Authority remove controls over maximum permitted consumption of new rubber beginning about September 1. With synthetic rubber output being increased and the natural rubber stockpile goal "within sight," there will be ample supplies of rubber available by fall, according to this industry group.

The overall defense mobilization program, however, gives indications of requiring new rubber in amounts equal to or greater than the peak monthly rate for the Armed Services during World War II. With the demand for rubber for civilian products still at or near the 100,000-ton a month level for the remainder of 1951, another new record for rubber consumption in this country may be in the making.

At the same time the reported desire of rubber goods manufacturers abroad to obtain increased amounts of American synthetic rubber for use in their products in order to have the same broad range of rubber raw materials for their operations as is available in America might be possible of at an early date.

Some of the comment of Harvey S. Firestone, Jr., chairman of the Firestone Tire & Rubber Co. and another delegate to the Rome rubber meetings, is pertinent.

"It is now time to take a realistic view on rubber," Mr. Firestone said. "The law of supply and demand should prevail, allowing natural rubber and synthetic rubber to find their proper place in world markets without interference from artificial price agreements."

Of course, total war this year or next year or any time in the foreseeable future would mean more instead of less need of industry controls both at the national and international level, but until such war comes, the newly developing world rubber situation calls for the minimum of controls in order that the rubber industry may continue to achieve its primary goal—operation at a profit to its stockholders, management, and workers.

"America's Age of Decision"

SOME comments of John L. Collyer, president of The B. F. Goodrich Co., before a meeting of the Industrial Relations, Counselors, Inc., in New York, N. Y., on May 22 on "America's Age of Decision" merit special mention.

"Taxation is pressing down on incentives and the burden of inflation is eating up the value of incentives. No one knows at what point this will cause Americans to slow down and, perhaps, to stop trying.

"The American people must decide how much of their incomes they want to spend as the government dictates and how much they want to spend as they choose."

R. G. Seaman

DEPARTMENT OF
PLASTICS TECHNOLOGY

Classification of Thermoplastic Resins from Their Plasticity Curves[1]

William H. Willert[2]

THERMOPLASTICS have been classified as to their chemical, physical, mechanical, and electrical properties.[3] Comparisons between the various commercially available resins as to their tensile strengths, specific gravities, solvent resistances dielectric characteristics, natural colors, moisture resistances, etc., can be found in a number of handbooks. Thermally, these resins are classified as to yield temperature, softening point, and melting temperature. Some resins, such as the cellulosics, are often compared on the basis of their ASTM flow temperatures.

Although handbooks list the injection and extrusion temperatures of the different thermoplastic resins, it is almost always necessary to make a series of runs by the trial and error method to determine the proper temperature or conditions at which a particular plastic compound should be processed. The available information does not indicate how polymers behave over a full temperature range, starting at normal room temperatures and going up to temperatures well above the melting points of the resins. A search of available literature revealed that at least one study[4] has been made, and a method proposed,[5] to measure the viscosities of molten thermoplastics. Since this type of data is not readily available from the raw material suppliers on all commercially available resins, it is assumed that each processor has to make his own determinations.

The purpose of this paper is to show how the plasticity curve for a resin can be determined by a simple laboratory method and to indicate how the results may be utilized by the plastics processor. The method described can be installed in a plant for a total cost of about $350 and used by a non-technical person. The scope of the paper will be limited to the classification of some of the commercial resins used in the injection, extrusion, and other processing fields.

Definition of Terms

Plasticity is defined by Webster as the plastic quality or state and the ability to retain a shape attained by pressure deformation. For the purpose of this study, plasticity will be referred to as the softness or proneness to flow of a resin. A "high" plasticity will refer to the condition of a plastic that offers less resistance to flow, in contrast to "low" plasticity that is difficult to work.

The "plasticity curve" of a resin will refer to a curve where plasticity is plotted as a function of temperature at a constant pressure. Plasticity is measured in square inches of area; temperature in °F.; and pressure in pounds per square inch.

Description of Test

Samples having a volume of one cubic centimeter were used for the test. By this method all plastics are compared on the same volume basis, and the specific gravity does not become a factor. Furthermore in most processing operations the common basis is volume rather than weight of plastic. The test specimens consisted of plastic "buttons" 1.128 inches in diameter and 0.061-inch in thickness, thus giving an area of one square inch and volume of one cubic centimeter. These buttons or disks were molded in a Carver laboratory press, and 10 disks were usually sufficient to determine the plasticity curve of a particular resin.

Each resin used in this work was given the normal preparatory treatments used in regular production processing; acetates, butyrates, and methacrylates were dried; vinyls were compounded when not furnished as finished compounds; nylons were carefully removed from their vaccum sealed containers; and so on.

The disks were compression molded as follows: (1) resin was placed in the washer-type mold, which was then sandwiched between aluminum foils; (2) the assembly was placed between the platens of a Carver laboratory press, preheated for 30 seconds, and then pressed for 30 seconds at 10,000 psi. pressure, using the lowest possible temperature required to obtain a good sample; and (3) the assembly was taken from the press; the foil stripped off; the disk taken out of the mold; and the flash carefully removed.

To determine the plasticity at a given temperature, the disk was sandwiched between aluminum foils about 5½ inches square in size, and the assembly placed between the platens of the Carver press. The platens were closed, and the sample allowed to preheat for a predetermined period of time. After preheating, the pressure was increased to a preset level, held constant for a definite time interval, and then released, and the sample removed. The wrapped sample was then cooled rapidly; the foil stripped off; and the area of the resulting plastic plaque measured. The area of the plaque was measured by tracing an outline on to coordinate paper and then counting the squares enclosed by the outline. Other methods of measuring the area, such as by means of a planimeter, etc., can also be used with good results.

In this study the thickness tolerance on the disks was held to a value of ±0.002-inch; the preheating time to one minute; the pressing time to one minute; and the hydrostatic pressure to 2,500 psi. on a 1¼-inch ram. A study made on the effect of preheating on the plasticity results obtained with polyethylene resin showed the minimum preheating time to be 45 seconds, and a one-minute period was used to insure consistent results. Likewise, one minute was shown to be the most effective pressing time, since shorter times introduced errors arising from the time required to raise and lower the pressure; while longer pressing times resulted in decomposition of the sample at the higher temperatures used in the test. The hydraulic pressure used is believed to represent the minimum to average value used in an extruder.

The plasticity values for the various resins were determined by varying the temperatures and keeping the pressures constant. The resulting plasticity values were then plotted as a function of temperature to give the plasticity curves of the resins. Temperature intervals of 20° F. were found to be satisfactory for this purpose.

Test Results

Plasticity curves for the following 10 commercially available resins were determined:

- Cellulose Acetate, H-Flow
- Cellulose Acetate Butyrate, H-Flow
- Ethyl Cellulose, Approximately M-Flow
- Methyl Methacrylate, Medium Flow
- Nylon, Rigid FM-10001
- Polyethylene, 20,000-21,000 Molecular Weight
- Polychlorotrifluoroethylene, Kel-F 270 (Unplasticized)
- Polyvinyl Chloride, Plasticized to 80 Durometer Hardness
- Saran, S-548 Type B-115
- Polystyrene-Standard Extrusion and Injection Grade

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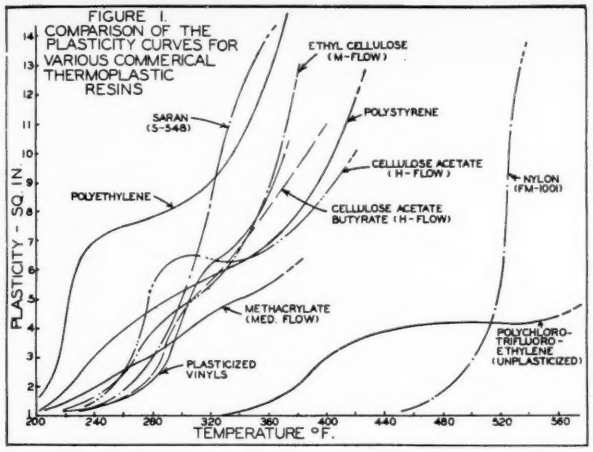

FIGURE 1. COMPARISON OF THE PLASTICITY CURVES FOR VARIOUS COMMERICAL THERMOPLASTIC RESINS

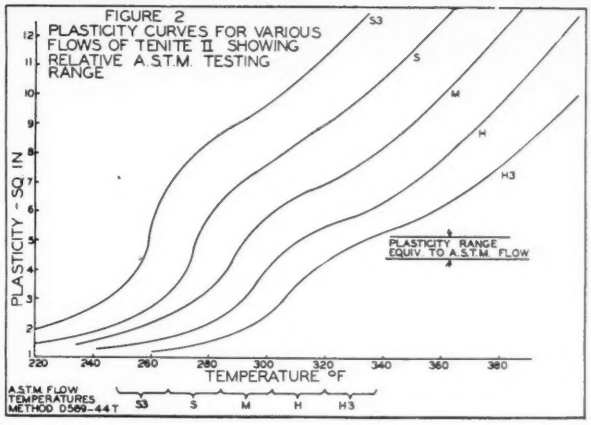

FIGURE 2. PLASTICITY CURVES FOR VARIOUS FLOWS OF TENITE II SHOWING RELATIVE A.S.T.M. TESTING RANGE

Figure 1 gives a comparison of the plasticity curves for these resins. An examination of this figure shows that the curves for saran and nylon are quite similar. Although their melting points are 280° F. apart, both of these resins have very sharp melting points and rapidly transform to states of high plasticity.

Polychlorotrifluoroethylene shows the lowest plasticity of the resins tested and has a broad softening range. From the softening point (about 440° F.) to its melting point of about 550° F. the curve is almost flat, indicating that a temperature increase has very little effect on the flow or plasticity of this resin. As the temperature is raised above 560° F. the plasticity is slightly increased, but this effect is partially due to slight decomposition of the resin in the exposure time used.

The grades or types of polystyrene and methyl methacrylate used in the test show the same general type of curve. Both resins show signs of having slight softening point ranges, but for all practical purposes the plasticity can be taken to vary uniformly with temperature over the range from the beginning of flow to the start of decomposition. Polystyrene has a wider working range than the methacrylate, but its upper end is limited by discoloration of the resin. When methacrylate reaches a temperature of 365° F. it begins to depolymerize, resulting in monomer bubbles. Polystyrene also starts to break down into monomer at about 390° F. in the two-minute test exposure, but with shorter exposure times it is possible to raise this breakdown temperature to about 500° F. In either case, however, discoloration of the polystyrene will occur if air and moisture are not eliminated from the system.

The curves for the cellulosic resins show the effects of modifying the basic cellulose structure with aceto, butyl, and ethyl groups which act as internal plasticizers, in addition to the regular organic plasticizers used in the molding compounds. Cellulose acetate resin appears to be a physical mixture of the flake plastic and plasticizer up through the softening point range. For the H-Flow compound used, the plastic begins to soften at 240° F. and plasticity increases rapidly as the temperature nears 300° F. As the temperature increases further, the flow decreases slightly, apparently the result of complete compatibility between the polymer and plasticizer components. This compatibility effect was more pronounced in the hard flow resins and minimized in the softer flows where the percentages of plasticizer are greater. When the test specimens were being prepared, it was noticed that the transparent samples became much clearer at this flow-decreasing point, an observation in accordance with the compatibility theory. Cellulose acetate plasticity increases uniformly from 340 to about 390° F., at which point plasticizer bubbles begin to appear.

Modification of the cellulosic structure to produce an ethyl cellulose molding compound of approximately M-Flow minimizes the softening point effect shown by the acetate compound. In addition, this effect was only slightly apparent with the cellulose acetate butyrate compound. The plasticities of both the butyrate and ethyl cellulose compounds increased fairly uniformly with temperature rise and were both limited by plasticizer vaporization.

In order to determine how the plasticity data obtained by the test method employed correlated with the various ASTM flow temperatures and classifications, curves were obtained for five different flows of Eastman's Tenite II (cellulose acetate butyrate) and are shown in Figure 2. Here the plasticities of the S3, S, M, H, and H3 flow grades of Tenite II are plotted against temperature, with the ASTM ranges (Method D569-44T) shown for the various grades. Comparisons indicate that the ASTM flow temperatures can be taken as those required to produce plasticities in the range of 4.4-5.1 square inches. It may be possible to narrow further this range with additional work.

The flow of vinyls can be varied to a great extent, depending on the compounding ingredients used. Along with the amount of filler, the type and the percentage of plasticizer used have the greatest effect on the flow. Among the plasticizers, solvent types have the greatest effect, extender types a moderate effect, and polymer types (including nitrile rubbers) the least effect on flow. In addition, most vinyls are copolymer-type resins, and the resins themselves can be varied to a great extent.

The vinyl compound used in this study is a general-purpose extrusion grade having a Shore durometer hardness of 80 and is commonly used for garden hose, tubing, belting, and similar products. This compound begins to soften at about 240° F. and is in a thoroughly fused state at 300° F. The plasticity curve indicates that the working temperatures for this resin can be extended up to about 360° F., the point where resin decomposition and plasticizer vaporization are imminent. Although the plasticity curve does not show the uniform increase with temperature displayed by polystrene, there are no indications of any critical changes or reversals in flow as shown by the cellulose acetate.

Polyethylene has a large, sweeping plasticity curve covering a wide temperature range. This is due primarily to the fact that it is a linear polymer of fairly high molecular weight, contains no plasticizer to volatilize, and has excellent heat stability. The resin softens and its flow increases rapidly between 220 and 250° F. Between 320 and 350° F. there is another sharp break in plasticity which corresponds to the so-called melting point of the resin. From 350° F. up the plasticity increases rapidly, and the resin becomes so fluid that it is impossible to measure it by the test method used.

Application of Test Results

It is evident from the test results discussed above that the flow characteristics of a compound over its entire workable processing range cannot be judged from any segment or portion of its plasticity curve. Only when different flows of the same compound are used can segments be compared, and even then an error may arise since similar sections may show identical flows while other portions of the curves vary for the two compounds. This type of error is shown by the cellulose acetate curves.

It is felt that by expanding the suggested test and comparing the curves obtained with the conditions used to process the various compounds, a scientific approach to the problems of the plastics molding and extrusion industries can be made. Once an operator knows how to run one compound effectively, by use of the plasticity curves he should be able to change over to another compound with a minimum of effort and trial and error.

The plasticity data, furthermore, may lead to a better understanding of a number of controversial points in the design and operation of injection and extrusion machines. In extrusion, engineers are concerned with the land length, screen pack, die design, extrusion rate, screw design, screw temperature, cylinder temperature, die temperature, and the removal of frictional heat. It is evident from the plasticity curve for polyethylene in Figure 1 that more and finer screens, along with a shorter die land, could be used in film extrusion at temperatures of 320° F. and up. On the other hand, fewer and coarser screens and a longer die land can be used when pipe is extruded from the same polyethylene resin at a much lower temperature range. Likewise, in the wire covering field one would not expect to be able to use the same sizing die for both polyethylene and vinyl compounds on the basis

of their plasticity curves, but this is often attempted in practice and results in lower production rates or rough finishes.

In the injection molding field there are controversial points concerning proper cylinder temperatures and cycle speeds, molding pressures, mold design with respect to runner length and size, gating, and mold temperatures. Pin point gating, a recent development, would appear to be an effective means of creating frictional heat as the material enters the cavity, thereby maintaining the plastic temperature high enough to assure filling the mold and preventing laminations when used on polystyrenes, acetates, methacrylates, and other compounds of low plasticity. This type of gating is less effective with nylon and saran which display high plasticities. With plasticity data available on a comparative basis it should be possible to approach the problems scientifically, provided plastic temperatures are controlled at a known level.

The scope of the test could also be expanded to other fields, such as press polishing, lamination, form molding, and compounding. A further use of the test could be to study or compare cold flow, heat stability, softening and melting points, and the effects of preheating, pressure, and temperature on the flow of various resins. The test can also be used for comparative production control checking of lots of batches of resin used in a plant.

Summary and Conclusions

This study is not intended as the answer to the molding problems found in the plastics industry, but rather to show that the accepted flow classifications of the various commercial thermoplastics are not adequate for processing purposes. The industry as a whole has not settled on one or a series of flow testing methods that can be applied effectively to all thermoplastics. Such a condition is characteristic of a relatively young and expanding industry, and better flow standards and correlations are sure to develop.

Some slight modifications of the proposed plasticity test should be used to obtain best results. These modifications would include carrying out the test in an enclosed system or in an inert atmosphere; use of an accumulator to obtain constant pressure; and use of automatic temperature controls to reduce errors and facilitate performance of the test. These details could be worked out by manufacturers of laboratory testing equipment.

Acknowledgments

The writer takes this opportunity to thank the raw material suppliers for their help and cooperation in supplying the samples used; Fred S. Carver, Inc., and others who allowed the use of their laboratory equipment; and to Hartig Engine & Machine Co. for the assistance and encouragement that made it possible for this paper to be entered in the 1950 SPE Prize Paper Contest.

Plastics Forum

AN OPEN house and plastics forum were held by Amos Molded Plastics, Division of Amos-Thompson Corp., Edinburg, Ind., April 24-26, to preview the operation of its new 300-ounce injection molding machine, built by Watson-Stillman Co. Some 150 Eastern and Midwest industrialists were guests of the company at the affair, which included demonstrations of the new molding machine, tours through the company's plant, a series of exhibits of industrial designers' drawings and plans for new products, panel discussions on subjects of immediate interest to the industry, and a daily forum at which talks were given by leading authorities.

Forum speakers follow: "Horizons Unlimited," Dale Amos, general manager of the company; "Supply of Thermoplastics Molding Materials, "William T. Cruse, executive vice president, Society of the Plastics Industry, Inc.; "Expansion of Material Production Facilities to Meet Future Demands," Donald L. Gibb, Dow Chemical Co.; "Potential Government Uses for Styrene Plastics," James R. Turnbull, Monsanto Chemical Co.; "Injection Molding," Frank G. Helander, Watson-Stillman; "Cost of Plastics Casting *versus* Other Materials," J. C. Kazimier, Amos chief engineer and sales manager; and "Research in the Plastics Industy," T. C. Keeling, Jr., Koppers Co., Inc.

Mr. Amos' talk was introductory in nature, reviewing the rapid growth in size of injection machines and molded parts during the past five years and forecasting continued growth in the production of larger machines and molded parts.

Mr. Cruse noted that the production of thermoplastic molding materials has risen from 20,000,000 pounds in 1940 to an estimated 465,000,000 pounds in 1951. Polystyrene accounted for 250,000,000 pounds in 1950 (of a total of 459,000,000 pounds) and found major application in refrigerator parts, industrial parts, wall tile, housewares, toys, and other items. A forecast of polystyrene supply involves both short- and long-term prospects. Short-term prospects are confused by the synthetic rubber picture and are uncertain. Long-term prospects depend on supplies of raw materials, and an expansion of such production facilities indicates ample supplies of raw materials for styrene before the end of this year.

Mr. Gibb said that polystyrene molding material supplies have maintained a close relation to molding machine capacities and sizes during the past. While the present shortage of polystyrene has resulted from a shortage of benzol, the government has announced its intention of raising the production of petroleum-derived benzene from its present level of about 12,000,000 gallons a year to 100,000,000 gallons a year. In addition, some styrene producers are studying the practicability of making a monomer based on toluene which is in easier supply and gives a product indistinguishable from benzene-derived styrene. In the absence of a shooting war, Mr. Gibb estimated that the supply of molding powders will be adequate to meet any growth the industry will make within the next few years.

Mr. Turnbull reviewed the role of plastics during World War II, noting that many applications were made on a trial and error basis. Today, however, if plastics are planned into military programs, they can free 10-15 times more critical materials, in terms of tonnage, than they did during the late war. In fact, as a material for construction, plastics rank next to steel if proper adjustment is made for specific gravity. The speaker also demonstrated various plastics products for military uses where the properties of the plastics have made them superior to previously used materials.

Mr. Helander reviewed the growth in size of injection machines from 2-300 ounces in capacity. In all probability, the next step in capacity in the foreseeable future will be a machine of 750-1,000 ounces, with a clamping unit of 3,000 tons or more, a maximum clamping stroke of 60 inches, and a die space of about 72 by 96 inches. The design and development of such a machine will present many problems which should not be too difficult for practical solution.

Mr. Kazimier noted that technological advancement in the plastics field, as in other industries, is spurred by economic advantages. Besides lower costs provided by mass-production molding methods, plastics also offer economies in transportation costs by means of lower weights, maintenance costs, etc.

Mr. Keeling stated the three important phases of research in the plastics industry are: (1) technical research by the material manufacturers; (2) applied research through the medium of end-use sales by material manufacturers' personnel; and (3) applied research on the part of molders, extruders, fabricators, and end-use manufacturers. The speaker discussed these phases in detail and noted that while they can be separated and still function successfully, they should be carried on in a cooperative manner to achieve the goal of expanded use of plastics while maintaining quality, suitability of the product for the application, and economy.

Monthly Reports from SPE Sections

A TALK on "Hydraulics in the Plastics Industry," by E. O. Clark, Vickers, Inc., division of Sperry Corp., featured the May 16 dinner-meeting of the New York Section, held at the Hotel Shelburne, New York, N. Y., and attended by some 50 members and guests.

Mr. Clark noted that hydraulics have come into universal use, despite the availability of other methods of utilizing power, because no other medium combines the same degree of positiveness, accuracy, and flexibility of control with the ability to transmit a maximum of power in a minimum of bulk and weight. Using slides to illustrate his talk, the speaker discussed the design and operating principles of the hydraulic system in an injection molding machine, both single and two-stage hydraulic pumps, variable delivery pumps, hydraulic motors, and hydraulic transmissions.

The second portion of the talk was devoted to the need of proper maintenance of hydraulic equipment. A recent analysis of service calls to customers' plants on hydraulic equipment shows the following approximate distribution of causes for failures: 70% due to improper condition of the hydraulic oil; 10% due to improper diagnosis of the trouble and insufficient knowledge to make proper repairs; 10% due to mechanical failures; 5% due to operating units beyond recommended limits on speed, pressure, or volume; and 5% due to miscellaneous causes.

Mr. Clark emphasized that a proper maintenance program on hydraulic equip-

ment should embody the following aims: (1) recognize that the user of hydraulic equipment has more control over maintenance than the manufacturer, and use this control effectively to reduce down-time; (2) standardize on one make of hydraulic equipment for all machines in the plant in order to centralize responsibility for maintenance, secure better trained maintenance men, and eliminate the problems presented by the non-interchangeability of hydraulic units or parts made by different manufacturers; (3) maintain a stock of spare hydraulic parts and units to avoid down-time during repairs; (4) before buying a hydraulic machine check to make certain it will meet both your production and maintenance requirements; (5) use the best hydraulic oil available, keep it in good condition, and change it as often as necessary; (6) instruct the machine operator on the functions and limitations of the hydraulic equipment in his machine; (7) select good men for the hydraulic maintenance staff and train them as specialists; (8) set up a planned program of systematic preventive maintenance for your hydraulic equipment; (9) on actual repairs analyze and isolate the trouble before dismantling any part of the hydraulic circuit; and (10) make use of the repair or service department of the hydraulic equipment manufacturer on any maintenance problem that you are unable to handle.

In a brief business meeting preceding the talk, reports were heard from President George Baron, Ideal Plastics Corp.; Secretary-Treasurer Arthur L. GeWertz, manufacturers' representative; Program Chairman Winslow A. Ward, American Cyanamid Corp.; Prizes and Favors Chairman Richard Stott, Stott Tool & Machine Co.; and a report on the recent national directors' meeting by Stanley Bindman, Jamison Plastics Corp. Table favors were distributed through the courtesy of Mr. GeWertz, and the meeting closed with a drawing for door prizes donated by Crown Sanitary Products, Inc., and Brilhart Plastics Corp.

Need of Industrial Publicity

A talk on "How to Publicize Your Industrial Product," by Harold Schor, industrial publicist, highlighted the April 20 meeting of the Central Ohio Section, held at the Berwick Hotel in Cambridge, Ohio.

In a brief business meeting prior to the talk, President Henry Kuhlman, Battelle Memorial Institute, received nominations for the election of officers to be held at the next meeting. The speaker was introduced by President-Elect Robert W. King, also of Battelle.

Mr. Schor pointed out that industrial publicity ranks on a par with direct selling, sales promotion, and paid advertising in transmitting information from a manufacturer to his potential customers. Industrial publicity consists of new product releases, syndicated news releases, full-length articles, and externalized house organs. Values to be derived from such publicity include uncovering and exploring new markets, introducing new products, building good relations with dealers, and building the prestige of the company. After describing the different types of trade magazines, Mr. Schor listed mistakes often made in industrial publicity, including old material disguised as new, mailings to publications not in the field, excess wordage, excessive sales talk included in release, and others.

Chicago Hears Bushman, Healy

Talks on "Reinforced Plastics," by Edwin F. Bushman, General American Transportation Corp., and "Why Beryllium Copper?" by Melvin Healy, Manco Products Corp., featured the May 9 joint dinner-meeting of the Chicago Section, SPE, and Midwest Chapter, SPI. The meeting was held at the Builder's Club, Chicago, Ill., and attended by 130 members and guests of the two groups.

Mr. Bushman described the principles of compounding reinforced plastics, some of the fabricating methods used, and the properties which can be obtained. Reinforced plastics are essentially glass yarns or fabrics impregnated with a catalyst-activated thermosetting resin. Mineral fillers, such as calcium carbonate, are used to lower the product cost. Because solvents are not used, and no gas is evolved during the process, it is necessary to exert only enough pressure during curing to keep the component parts of the product in contact with each other. Frequently sufficient molding pressure is obtained by simply wrapping the piece with cellophane. The principal applications of reinforced plastics are based on their high tensile and flexural strengths and impact resistance. The speaker, who showed samples and slides of important civilian and military applications, also described some of the projected military uses.

Mr. Healy discussed the advantages of beryllium copper over other mold metals, emphasizing that beryllium copper should be used only for injection molds and not compression molds. The material provides high hardness, high tensile strength, and great resistance to fatigue, wear, and corrosion. Beryllium copper has relatively low initial costs, and its good workability permits the rapid manufacture of molds, especially hobbed molds for intricate shapes.

CALENDAR

June 14.	New York Rubber Group. Annual Outing. Doerr's Grove, Millburn, N. J.
	Rubber & Plastics Division, ASME. Royal York Hotel, Toronto, Ont., Canada.
June 15.	Akron Rubber Group. Firestone Country Club.
	Boston Rubber Group.
	Rubber Chemistry Division, C.I.C. Walper House Hotel, Kitchener, Ont., Canada.
	Chicago Section, SPE; Midwest Chapter, SPI. Golf Outing. River Forest Golf Club, Elmhurst, Ill.
June 17-July 3.	Japanese Trade Fair. Seattle, Wash.
June 18-22.	American Society for Testing Materials. Annual Meeting. Atlantic City, N. J.
June 22.	Detroit Rubber & Plastics Group, Inc. Summer Outing. Forest Lake & Country Club, Pontiac, Mich.
June 23.	Southern Ohio Rubber Group. Outing.
July 20.	Buffalo Rubber Group. Outing. Lancaster Country Club.
July 24.	Chicago Section, SPE; Midwest Chapter, SPI. Golf Outing. Rolling Green Country Club, Arlington Heights, Ill.
Aug. 3.	Chicago Rubber Group. Golf Outing.
Aug. 7.	New York Rubber Group. Golf Tournament. Baltusrol Golf Club, Springfield, N. J.
Aug. 17.	Chicago Section, SPE; Midwest Chapter, SPI. Golf Outing. River Forest Golf Club, Elmhurst, Ill.
Aug. 24.	Philadelphia Rubber Group. Annual Outing. Cedarbrook Country Club, Philadelphia, Pa.
Sept. 2-8.	American Chemical Society, New York, N. Y.
Sept. 5-7.	Division of Rubber Chemistry, A. C. S. Hotel Commodore, New York, N. Y.
Sept. 20.	Southern Ohio Rubber Group. Engineer's Club, Dayton, O.
Oct. 2.	The Los Angeles Rubber Group, Inc. Hotel Mayfair, Los Angeles, Calif.
Oct. 10.	Newark Section, SPE. Military Park Hotel, Newark, N. J.

Polystyrene Injection Molding

The Newark Section held its last regular dinner-meeting before the summer recess on May 9 at the Military Park Hotel, Newark, N. J., with more than 100 members and guests present. Speaker of the evening was R. W. Van Sickle, Dow Chemical Co., who discussed "Research and Application in the Injection Molding of Polystyrene."

Mr. Van Sickle first briefly outlined the scope of Dow's plastics organization, explaining the roles played by research, production, sales, and technical service. A workable molding technology has been developed during the past three years by applying engineering fundamentals, accumulated molding room observations, and research data to the solution of problems inherent in injection heating cylinders, nozzle design, and mold design.

Studies of the injection cycle indicate that the degree of sealing pressure is a critical factor in producing good moldings. The introduction of a ball-check nozzle proved effective in sealing off the plastic flow into the mold at the proper time, thereby preventing excessive packing in the cavity and resultant strained moldings. Film studies were shown of the injection of a low molecular weight polymer into a quartz mold. These films clearly showed how plastic can continue to pack into a full mold under continuing plunger pressure, and how plastic can leak from the mold back through the gate if the pressure is relieved before the gate seals.

Table favors were distributed through the courtesy of Kaye Plastics, Inc., and the meeting included a drawing for door prizes donated by Shaw Insulator Co. and Industrial Synthetics Corp.

Ebers Discusses Polyesters

The April 19 dinner-meeting of the Quebec Rubber & Plastics Group was held jointly with the local sections of the Society of Plastics Engineers, Inc., and the Society of the Plastics Industry (Canada). Some 90 members and guests of the three groups were present at the meeting, held in the Queen's Hotel, Montreal, P.Q., Canada. Featured speaker was Earl S. Ebers, Naugatuck Chemical Division, United States Rubber Co., who discussed "Polyesters."

Dr. Eber's talk covered the history of polyester resins and laminates, their properties, molding, and applications, and was similar to the talk he gave at the recent SPE National Technical Conference, reported in our December 1950, issue, page 325. Peter Hersey, Plastics & Chemicals, Ltd., presided over the joint meeting, and the speaker was introduced by R. G. Rea, Monsanto (Canada), Ltd.

Scientific and Technical Activities

Rubber Division, A. C. S., September, New York Meeting

THE Division of Rubber Chemistry, American Chemical Society, will hold its fifty-ninth meeting as part of the one hundred and twentieth meeting of the parent Society in New York, N. Y., September 5, 6, and 7. The Society is celebrating the seventy-fifth anniversary of its founding with an outstanding all-symposia technical program organized by its various Divisions for the Diamond Jubilee Celebration during the week of September 3 through 7, and the Rubber Division program consists of symposia on compounding, dynamic properties of rubber-like materials, ozone cracking, synthetic rubber, and rubber latex. Headquarters for the Rubber Division will be the Commodore Hotel.

J. H. Fielding, Armstrong Rubber Co. Division chairman, will preside jointly at the technical sessions with the symposia chairmen. He will also preside at the business meeting on the morning of September 6 and at the Division banquet on the evening of the same day at which the Goodyear Medal will be presented to William C. Geer, former vice president in charge of research and development of The B. F. Goodrich Co. A suppliers' cocktail party will precede the Division banquet.

A luncheon meeting of the 25-Year Club will be held at 1:00 p.m., September 5, in the East Room of the Commodore. A. A. Somerville, R. T. Vanderbilt Co., is chairman for this meeting.

The chairman in charge of arrangements for the Division meeting is D. E. Jones, American Hard Rubber Co., and the other members of this committee to be made up of Division members who are also members of the local New York Rubber Group will be announced next month.

The technical sessions of the Rubber Division will be held the morning of September 5, morning and afternoon of September 6, and morning and afternoon of September 7.

The afternoon of September 5 will be given over to a ceremonial program of the Society in the 71st Regiment Armory, 34th St. and Park Ave., at which delegates from sister societies, both domestic and foreign, will present scrolls and extend their felicitations to the A. C. S. in commemoration of its seventy-fifth anniversary. N. Howell Furman, president of the Society, will preside. James B. Conant, president of Harvard University, will deliver the address of the afternoon.

The Diamond Jubilee Anniversary banquet of the Society will be held beginning at 7:30 p.m., September 5, in the ballroom of the Waldorf-Astoria Hotel. Dr. Furman will preside, and Charles A. Thomas will be toastmaster. The President of the United States has been invited to address this assembly of members and guests. An address by C. E. K. Mees, Eastman Kodak Co., on "The Next 75 Years in Chemical Research" will also be heard. Rise Stevens, Metropolitan Opera star, will present a program of songs, and the banquet dinner will be followed by dancing.

The Goodyear Medalist

William C. Geer, former vice president in charge of research and development for Goodrich, who has been selected to receive the Goodyear Medal of the Rubber Division at this New York meeting, is a graduate of Cornell University, where he received his Ph.D. in chemistry and physics in 1905. During 1906 and 1907 he was employed by the United States Forest Service as an expert in wood distillation. He joined Goodrich as chief chemist in 1907, became director of development in 1916, vice president in charge of development in 1918, and vice president in charge of research and development in 1920. He retired in 1925 to engage in private research and consulting work.

Dr. Geer is distinguished for his many contributions to the rubber industry and in particular to rubber technology, but attention should be called to five principal lines of endeavor which have achieved world-wide prominence: (1) Geer modification of the Tissot gas mask of World War I; (2) accelerated aging tests for rubber compounds; (3) vulcanized cover for golf balls; (4) Vulcalock adhesives of rubber to other services; (5) invention of the airplane deicer overshoe. In addition Dr. Geer has made notable early contributions to age resisters for rubber and to a score or more of inventions having to do with rubber compounding and technology.

Dr. Geer is a member and fellow of the American Association for the Advancement of Science and the Institute of the Rubber Industry of Great Britain, a member of the American Chemical Society, American Institute of Chemical Engineers, American Institute of Chemists, and associate fellow of the Institute of Areo Sciences, and a member of other technical and fraternal organizations.

Program and Abstracts of Papers

WEDNESDAY MORNING—SEPTEMBER 5
Grand Ballroom—Commodore Hotel
Symposium on Compounding
A. E. Juve, Presiding

10:00 a.m.—**1. Introductory Remarks.** J. H. Fielding and A. E. Juve.

10:05 a.m.—**2. The Compounder in the Rubber Industry.** B. S. Garvey, Jr., Sharples Chemicals, Inc., Wayne, Pa.

This is a review paper dealing with the scope of the field of compounding, the role of the compounder in the industry, the manner in which he works, and the materials which he employs.

10:35 a.m.—**3. The Significance of Breakage of Carbon-Rubber Networks by Applied Stress.** A. F. Blanchard and D. Parkinson, Dunlop Rubber, Ltd., Birmingham, England.

The work was undertaken to throw more light on the carbon reinforcement of rubber by means of studying reinforced rubber when it has been softened by the application of stress in the manner first described by Mullins and afterward by the present authors. It was hoped that this approach would promote a clearer understanding of the nature of the attachments presumed to exist between carbon particles and rubber molecules. To facilitate quantitative estimates of the changes that occur during prestressing and their interpretation a semi-empirical mathematical expression has been derived which under certain conditions fits the stress-strain curve of reinforced rubber. The equation contains two parameters, G and μ, which depend on the quantity of carbon in the rubber and the degree of softening due to application of stress. The parameter, G, is roughly equivalent to the modulus given by the equation representing the simple statistical theory of elasticity of rubber-like polymers, and the extension factor, μ, is a rough measure of the deviation from theoretical behavior for a given extension. The presence of carbon black in the rubber increases the modulus, G, and also results in a departure from theoretical behavior which becomes very large as the extension is increased. This deviation may be interpreted as a result of limited extensibility of the rubber carbon-network under conditions where few bonds are broken.

Results so far obtained during the present study support the view that the stiffening of rubber by carbon black can be attributed mainly to linkages through carbon particles resulting from carbon-rubber bonds and assisted by any coherent chain structure which may be present. It is thought that the softening of reinforced rubber with stress is primarily due to rupture of carbon-rubber attachments and owes little to breakage of contacts between particles of carbon. A relatively small number of weak linkages stiffens the rubber at low elongations, and a small number of strong linkages stiffens the rubber at high elongations. Heat treatment under certain conditions of rubber-channel black stocks appears to increase the relatively small number of strong bonds so that rubber made from such heated stocks is abnormally stiff at high extensions although of normal stiffness at low extensions.

11:00 a.m.—**4. A Study of Carbon Black Dispersion and Reinforcement.** E. M. Dannenberg, Godfrey L. Cabot, Inc., Boston, Mass.

The most generally recognized characteristic of a good reinforcing filler for rubber is small particle size. In the case of carbon blacks it has been shown by numerous investigators that reinforcement is enhanced as the particle size decreases. Since particle size cannot exert its influence on reinforcement unless the filler particles are dispersed or at least substantially wetted by the rubber matrix, it is necessary to investigate the importance of these factors. A mechanistic explanation of the reinforcement phenomenon must be based on an understanding of the morphology of the carbon black-rubber system. This study has attempted to determine to what extent changes in the degree of dispersion are reflected in reinforcement, and the minimum degree of dispersion necessary for its development.

The dispersion of a high abrasion furnace black in natural rubber, cold GR-S, butyl, nitrile, and neoprene was varied by controlling Banbury mixing times and speeds. Heat tempering of the carbon black-rubber masterbatch followed by cooling, and remilling was also used to obtain the best possible carbon black dis-

persions. Electrical resistivity measurements and electron microscope studies indicated that large differences in the degree of carbon black dispersion for the various stocks were obtained. Abrasion loss and other physical test data showed that in some instances a low degree of reinforcement was obtained with very poor dispersion. In these cases the dispersion was so poor that large unwetted aggregates were clearly visible in the unvulcanized stocks. Essentially, however, full reinforcement was achieved with a minimum of mixing. Judged by electrical resistivity, the degree of dispersion in these vulcanizates would still be classified as poor. Further mixing to give better dispersions did not result in a higher level of reinforcement. These results seem to indicate that in order to develop the full reinforcing effect of carbon blacks it is necessary to disperse the aggregates to a degree consistent with the formation of a substantial amount of interfacial surface. Further improvements in dispersion which result in relatively small increases in interfacial surface have only minor effects on the level of reinforcement.

These results demonstrate that the reinforcing effect of carbon black is relatively insensitive to the degree of its dispersion. It is of practical interest to note that for this reason the quality of rubber products containing carbon blacks is not influenced greatly by the use of widely different processing equipment and mixing techniques.

11:23 a.m.—**5. Some Properties of Butyl Rubber-Carbon Black Systems.** F. P. Ford and A. M. Gessler, Standard Oil Development Co., Linden, N. J.

The properties of butyl rubber-carbon black systems have been investigated in both the unvulcanized and the vulcanized state. Several different types of furnace and channel black have been considered in this work. In studying unvulcanized systems attention was given first to the processing behavior of such systems in different degrees of dispersion. The degree of dispersion was determined by photometry of dilute suspensions, plastometric methods, and the electron microscope. The effect of varying dispersion was determined by such methods as extrusion and calendering.

A second phase of the study of unvulcanized systems was directed toward a better understanding of the nature of reinforcement of butyl rubber by carbon black. In this work, use was made of rheological tests, photometry, bound rubber determinations, and electrical properties. With such techniques, observations were made to the effect on these systems of aging, and temperature and pressure changes as well as variations in mechanical dispersion.

In evaluating the vulcanizate properties of these mixtures, use was made of several specialized procedures as well as the more conventional rubber tests. Equilibrium modulus, internal viscosity, and damping effects were determined with such procedures. The effects of various processing techniques were studied in this manner. This work has indicated new methods for the improvement of important properties of butyl rubber compounds.

11:45 a.m.—**Estimation of the Wear Resistance of Vulcanized Elastomers.** J. C. Burns and E. B. Storey, Polymer Corp., Ltd., Sarnia, Ont., Canada.

The lack of a satisfactory laboratory measure of the wear resistance of vulcanized elastomers has delayed the development and acceptance of new elas-

William C. Geer

tomers for tire service. The ethanol-toluene extraction method (Griffith *et al.*) offered a means of obtaining a closer relation between laboratory and service wear tests. It has been observed that this method did not rank GR-S and low-temperature GR-S vulcanizates in the order obtained in road wear tests.

Room-temperature immersion of tread vulcanizates in ethylene dichloride, or acetone, resulted in a significant decrease in abrasion resistance, but less than that obtained by the ETA extraction treatment. A specific percentage decrease in abrasive resistance was obtained for each treatment over a range of carbon black loadings.

The order of abrasive resistance of GR-S and low-temperature GR-S vulcanizates could be changed by reducing the size of the abrasive grit, and a 4/0 Garnet paper indicated a lower rate of wear for the low-temperature GR-S vulcanizate.

When a steel screen was employed with the National Bureau of Standards abrader, in place of the abrasive paper, the rate of wear was reduced by a factor of about 50. The wear resistance on the screen increased with the state of cure of the vulcanizate, and a maximum value was observed at a cure slightly beyond the optimum tensile cure. Low-temperature GR-S vulcanizates showed the higher maximum wear resistance over a range of wire and mesh sizes and also on a metal grid surface.

The wear resistance of these two elastomers decreased, and became more nearly equal, with an increase in the softener content of the vulcanizate. A low wear resistance value was obtained when surface deterioration of a natural rubber vulcanizate produced a black smear on the metal screen.

The effect of different grades of carbon black on the wear resistance of tread-type vulcanizates was in the same order as that reported for road wear tests.

12:08 p.m.—**7. The Effect of Metallic Oxides on the Vulcanization of Neoprene Type W.** F. H. Fritz and L. R. Mayo, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Neoprene Type W, to a greater extent than other neoprenes, requires the use of organic accelerators to supplement the conventional metallic oxide (zinc oxide, magnesia) curing agents in producing optimum vulcanizate properties. The basic curing system, therefore, consists of at least three components which, when varied, produce compounds differing considerably in behavior. This paper reports the results of a further investigation directed toward the more efficient use of this inherently flexible vulcanization system. The paper is based on observations of variations in processing safety, rate of cure, state of cure, and aging in Neoprene Type W compounds that occur when the type and the concentration of zinc oxide and magnesia are varied in the presence of several different accelerators.

The effect of varying type and amount of metallic oxides on processing safety (as judged by the Mooney scorch test) differs greatly with the accelerator employed. Stocks accelerated with 2-mercaptoimidazoline (NA-22), p,p'diamino-diphenylmethane (Tonox), or diphenylguanidine-sulfur are very insensitive to such variations. On the other hand, compounds accelerated with the di-ortho-tolyguanidine salt of dicatechol borate (Permalux), salicylic acid (Retarder W), or 2-mercaptothiazoline (2-MT)-sulfur are markedly influenced by these changes.

In the presence of this latter group of accelerators, particularly Permalux, improvements in processing safety are obtained by increasing the concentration of magnesia and decreasing the zinc oxide as well as by selecting specific grades of these oxides. Safety is promoted by the use of either French process or specially washed American process zinc oxide in combination with an extra-light calcined magnesia.

Despite the substantial gain in processability realized by these adjustments in compounding the rate of cure at conventional temperatures, e.g., 153° C. (307° F.), is not seriously reduced, and the state of vulcanization (as judged by modulus, compression set, and resilience) attained in reasonable curing times is fully equivalent to that reached with more scorchy combinations.

This method of obtaining a desirable balance between processability and rate of vulcanization is particularly advantageous in carbon black loaded stocks. A reduction of zinc oxide concentration in the normal range moderately impairs resistance to high temperature aging; however, no adverse effect is observed on samples exposed in the 70° C. oxygen bomb or to weathering in direct sunlight.

The broad conclusion is drawn that the adjustment of the amount or the type of zinc oxide or magnesia, in the presence of a "sensitive" accelerator such as Permalux, is a valuable technique in producing well-balanced compounds of Neoprene Type W.

WEDNESDAY AFTERNOON—SEPTEMBER 5

East Room—Commodore Hotel

1:00 p.m.—**25-Year Club Luncheon.** A. A. Somerville, chairman.

71st Regiment Armory, 34th St. and Park Ave.

2:30 p.m.—A. C. S. Ceremonial Program.

Waldorf-Astoria Hotel

7:30 p.m.—A. C. S. Diamond Jubilee Anniversary Banquet.

THURSDAY MORNING—SEPTEMBER 6

Main Ballroom—Commodore Hotel

Symposium on Dynamic Properties of Rubber-Like Materials

J. W. Liska, Presiding

9:00 a.m.—**8. Introductory Remarks.** J. H. Fielding and J. W. Liska.

9:10 a.m.—**9. Dynamic Properties of Rubber.** S. Marvin, National Bureau of Standards, Washington, D. C.

Rubber is one example of a class of materials known as viscoelastic, since they exhibit both viscous and elastic properties. As a result, only part of the energy required to deform a sample is stored and returned on release of the deforming force; while the remainder is dissipated as heat.

Viscoelastic properties may be expressed by several theoretically equivalent functions, including the creep function, the stress-relaxation function, and the dynamic modulus function. The dynamic modulus function, a complex or two-part function, depending on both frequency and temperature, can be measured directly only by experiments which employ steady-state sinusoidal stress and strain. It can, however, be calculated with varying degrees of approximation from experimental determinations of the period and attenuation of a mass-spring system undergoing free, damped vibrations, where the rubber sample provides the "spring"; from measurements of wave-length and attenuation of transverse, longitudinal, or compressional waves in a rubber sample; or from measurements on a "vibrating reed" sample.

The dynamic modulus function is dependent on frequency, although in certain ranges of temperature and frequency the change is so gradual that it has not been detected in some experimental investigations. The qualitative equivalence of temperature and frequency (decreasing the temperature affects the modulus in the same way as increasing the frequency) has been realized for some time. Recently Ferry[1] developed a quantitative expression for this equivalence which is supported by experimental determinations over a wide frequency range.

The prediction of performance of rubber articles based on dynamic tests is complicated by the fact that in most applications the rubber is subjected to a very complicated system of strains and also by the presence of fillers of various types. One factor which has made interpretation and comparison of various results difficult has been the rather poor reproducibility attained in many types of dynamic measurements, and another has been the failure to maintain sufficiently close temperature control in some experiments. With the recent advances in the techniques of making such measurements, and the improved understanding of the effects of frequency and temperature, it seems reasonable to expect that the next few years will see a great advance in the application of dynamic measurements both to the determination of the effects of structure on mechanical behavior and to the testing of rubber stocks and products.

9:45 a.m.—**10. Correlation of Dynamic and Static Measurements on Rubber-Like Materials.** R. D. Andrews, Dow Chemical Co., Midland, Mich.

Dynamic and static measurements on rubber-like materials can be related in terms of a generalized Maxwell model assumed to represent the mechanical behavior of the system; the individual characteristics of the system is expressed by the nature of the relaxation time distribution of the model.

Such properties as dynamic modulus and dynamic viscosity measured in experiments involving sinusoidal vibrations, and static modulus measured in experiments of relaxation of stress at constant strain can be expressed by integrals involving the distribution of relaxation times. The distribution of relaxation times can therefore be calculated from experimental data of this sort by suitable mathematical methods. Because of the complexity of such calculations when carried out rigorously, the use of approximate methods is often desirable.

A number of useful approximate relations can be derived by consideration of a "logarithmic box" distribution of relaxation times. The behavior of systems characterized by distribution representing extreme deviations on both sides of the box distribution has also been investigated for comparative purposes. Other approximations and additional information can be obtained by an analysis of the mathematical structure of the integrals relating the distribution of relaxation times to the observed static and dynamic physical properties. A frequently used approximation is that in which the value of the distribution function of relaxation times, in terms of logarithmic time, is assumed to be numerically equal to the slope of the static modulus curve plotted *vs.* logarithmic time, or to the slope of the dynamic modulus curve plotted *vs.* logarithmic reciprocal frequency. The possibility of deriving correction terms to these relations, to obtain more exact expressions, will be discussed.

An examination of published data in which correlations of static and dynamic experiments are attempted on the basis of this general theory shows that reasonably successful correlations are obtained. As illustrations, comparisons of static and dynamic modulus data on polyisobutylene by the author, predictions of dynamic viscosity of vulcanized rubbers from relaxation (static modulus) data by Dunell and Tobolsky, prediction of free vibration behavior of vulcanized rubber from creep data by Kuhn and Kunzle, and prediction of dynamic behavior of various plastic materials from creep data by Lethersich will be described.

10:05 a.m.—**11. Dynamic Mechanical Properties of Polisobutylenes in the Audio Frequency Range.** J. D. Ferry, University of Wisconsin, Madison, Wis.

The dynamic rigidities and dynamic viscosities of several fractionated and unfractionated polyisobutylene samples have been measured by a twin transducer from 25 to 4,000 cycles/sec. over a large temperature range, in collaboration with E. R. Fitzgerald and L. D. Grandine, Jr. Reduced variables are employed to interrelate the frequency and temperature dependence and to obtain the dynamic rigidity and viscosity reduced to 25° C. over an extended frequency range. The distribution function of relaxation times is calculated from both the rigidity and the viscosity, and its dependence on molecular weight and molecular weight distribution is discussed. The relations of the distribution function to other types of time-dependent mechanical behavior are shown.

10:25 a.m.—**12. Vibration Characteristics of Tread Stocks.** K. E. Gui, C. S. Wilkinson, Jr., and S. D. Gehman, Goodyear Tire & Rubber Co., Akron, O.

Non-linear vibration characteristics, as evidenced by a dependence of modulus and internal friction on amplitude are readily observed for tread stocks of both *Hevea* and synthetic rubbers in the mechanical range of frequencies. It can be shown in a number of ways that these effects are not due to temperature rise, although precise measurements of the effect are complicated by any temperature rise caused by the vibration. The effects occur for stocks reinforced with a fine silica pigment or with high styrene resin and for higher loadings of pigments generally considered to be non-reinforcing. Therefore they cannot be attributed to any unique feature of carbon black structure or dispersion. The pigment loading required for the same degree of non-linearity does depend on the particle size. Indications are that the non-linearity becomes pronounced when the thickness of the rubber films between the particles is comparable to the particle diameter. Unvulcanized tread stocks also are non-linear in vibration. Non-linearity occurs for vibrations both in shear and compression.

Measurements of the non-linearity for tread stocks over a range of temperatures suggest that the vibration elicits structural changes in the rubber analogous to those observed in the rheology of rubber solutions and raw rubber and that the nature of these structural changes can be interpreted by the rheological criteria of structure developed for non-Newtonian systems. In a sense the case represents the inverse of the usual non-Newtonian system in that the structural changes occur in the deformed medium rather than in the dispersed particles. Experiments were made to try to evaluate in the usual way the importance of such recognized mechanisms for non-linearity as orientation, deformation, and breaking and reforming of bonds of the flow units.

The non-linear effects appear to be sufficiently large that they should probably be taken into account in any exact studies of the effect of modulus on tread wear and performance.

10:45 a.m.—**13. Velocity and Attenuation of Ultrasonic Sound in Polymers.** J. L. Melchor, A. A. Petrauskas, E. Guth, University of Notre Dame, South Bend, Ind.

A pulsed method for the measurement of the velocity and the attenuation of ultrasonic sound in solids has been developed and applied to polymers previously.[2] The experimental technique has been considerably improved and permits in its present form a precision of about 0.03% in the determination of the velocity of sound. The range of frequencies extended from 500 kc. to 10 mc., and the temperature was varied from 15 to 105° C. Both the frequency and the temperature range can be extended with minor modifications in the equipment and the liquid medium used. The high degree of precision was aimed at particularly in order to be able to observe possible breaks at the second-order transitions for polymers, in the velocity of sound *vs.* temperature curve. Such breaks were reported in the literature[3] to occur for commercial polymethyl methacrylate. These breaks shifted with higher frequency to lower temperatures. In the present work breaks were observed in the velocity of sound *vs.* temperature curve, but the breaks shifted with increasing frequency to higher temperatures. The attenuation has also been measured. The theoretical significance of the results and also of similar measurement on other rubber-like polymers will be discussed.

11:05 a.m.—**14. A Study of High Polymeric Material by Ultrasonics.** G. I. Cathers, E. D. Bailey, A. M. Buchy and E. Asness, Franklin Institute, Philadelphia, Pa.

The use of high-frequency ultrasonics

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[1] *J. Am. Chem. Soc.*, 72, 3746 (1950).

[2] D. G. Ivey, B. A. Mrowca, E. Guth, *J. Applied Phys.*, 20, 486 (1950).

[3] *T. F. Protzmann*, Ibid., 20, 627 (1949).

to obtain information concerning the liquid state of polymer and elastomer compounds has been reported. Owing to the use of GR-S in the synthetic rubber program and to the gradual shift of the second-order transition point with composition of the copolymer, it was of interest to examine the ultrasonic method as a means of studying the butadiene-styrene copolymer system. A comparison of the ultrasonic behavior with the transition point was thus made possible. Some other polymers were also studied.

A major portion of the data was obtained through the use of diluted latex. The impedance match between water and rubber was sufficiently good to neglect the secondary scattering effect. A direct relation between the volume concentration and the absorption of ultrasonic energy was found to hold true at low concentrations. Attention was centered on measurement of absorption rather than on velocity due to the sensitivity of absorption to molecular structure. The frequency range extended from two to 90 megacycles. The temperature was also varied over a large range.

The absorption dispersion curves obtained over a temperature range were remarkably similar for all compositions and were comparable with the form for dielectric dispersion. Increase of the styrene content in the copolymer merely shifted the dispersion region upward on the temperature scale without markedly affecting the maximum absorption. This was changed by shift of composition in other copolymer systems; in the case of GR-S the maximum absorption was changed by vulcanization or by carbon black reinforcement. It was not dependent on molecular weight.

The dependence of absorption on the square of the frequency, usually obtained in the liquid state for a viscous process, was not found. The square-law relation was approximately true on the high temperature side of the dispersion region. On the low temperature side the relation was nearly linear. Addition of solvent to polymer was found equivalent to increase of temperature. The relations between composition, frequency, and temperature suggested that relaxational processes were involved. This point was confirmed by the usual relation between frequency and the exponential function of reciprocal temperature. The model for the relaxational process is discussed.

The correlation between increase of the second-order transition point and the shift of the dispersion region suggests that the same relaxational processes may be involved in both. Other authors have observed a relation between rate of deformation and the temperature of transition. The ultrasonic dispersion region represents a transition from a glass-like to a liquid-like stage. Extrapolation of the ultrasonic dispersion temperature from the megacycle range to a rate of about 0.1 cps. approximates the second-order transition points.

11:40 a.m.—**Business Meeting.**

THURSDAY AFTERNOON—SEPTEMBER 6
Main Ballroom—Commodore Hotel
J. H. Fielding, Presiding

2:00 p.m.—**Goodyear Lecture.** William C. Geer, consultant, Ithaca, N. Y. **"Strategy in Rubber Research."**

Symposium on Ozone Cracking
G. R. Cuthbertson, Presiding

2:40 p.m.—**15. Introductory Remarks.** J. H. Fielding and G. R. Cuthbertson.

2:45 p.m.—**16. Static Exposure Testing of Automotive Rubber Compounds.** H. A. Winkelmann, Dryden Rubber Division, Sheller Mfg. Corp., Chicago, Ill.

Deterioration of rubber products on outdoor exposure is due to the action of sunlight and ozone. Light energized oxidation produces a checked or crazed condition on the surface of the rubber. Ozone cracking results when rubber is exposed under strain. The type of cracking observed with ozone is not produced by other elements or materials normally in the atmosphere.

Protection against ozone cracking under static conditions is provided by a wax film that continuously blooms to the surface. The character of the wax bloom is important. Ozone is responsible for cracking which appears during dynamic flexing. Waxes do not give protection against cracking in standard flexing tests, as is the case on static exposure.

This study shows many variables influence the resistance of rubber products to ozone. The effect of processing, handling, and curing of compounds has been noted. The selection of a polymer such as natural rubber, GR-S, neoprene, or butyl rubber has a marked influence on ozone resistance of automotive rubber products. Unless a polymer is handled and compounded properly, good ozone resistance is not obtained. Microphotographs show that pigment dispersion and particle size play an important part in relieving internal strains and improving ozone resistance. The method of curing and molding, viz., extrusion, injection, compression, and transfer molding have been evaluated and show differences in weather aging. Rubber cured under strain cracks faster than when cured at rest. Manufacturing defects such as blisters, air traps, foreign matter, and pigment agglomerates result in premature cracking.

Manganese, copper, and iron salts in natural rubber and GR-S compounds have an adverse effect on ozone resistance in outdoor and accelerated exposure tests.

To obtain maximum uniformity the preparation and rating of test samples have been made according to the test method adopted by the SAE-ASTM Technical Committee on Automotive Rubber. Preparation and treatment of samples before exposure have a marked effect on the results obtained.

Ozone cracking on outdoor aged samples can be duplicated in an ozone chamber. In outdoor exposure the effect of sunlight, ozone, heat, and water varies seasonally in Florida, California, Detroit, Mich., and Chicago, Ill. Many tests and much good judgment must be exercised in correlating accelerated and outdoor exposure tests.

3:15 p.m.—**17. Ozone in Los Angeles and Surrounding Areas.** A. W. Bartel, United States Rubber Co., Los Angeles, Calif., and J. W. Temple, U. S. Rubber, Detroit.

For some considerable time it has been apparent that rubber products exposed to the atmosphere in the area of Los Angeles developed characteristic ozone cracking more rapidly than in most other parts of the United States. With this problem in mind, certain apparatus was used to make daily tests for atmospheric ozone for a period of a year. Values obtained were high. Air samples also were taken outside of the Los Angeles area, in the desert and on the ocean, away from the congested and air polluted areas with similar results—high ozone content. Correlating these data with that of daily psychrometric reports and daily maximum temperatures, a definite pattern of atmospheric ozone and weather could be observed.

The accumulated data are compared with information available from other areas and confirm that the Los Angeles atmosphere, during the period of measurement, was relatively high in ozone.

In connection with investigations of "smog" in Los Angeles, there has been some discussion of the possibility that much of the cracking of rubber is due not to ozone itself, but to peroxide compounds formed through reaction of ozone (or other oxidative systems) with unsaturated hydrocarbon contaminants in the industrial atmosphere.

To us this postulate seems unlikely and unnecessary for the following reasons:

Our analysis in Los Angeles proper, and in places remote from the city, showed apparent ozone concentrations of essentially the same order. We have found about the same order of rubber checking in both locations. We have trapped, by refrigeration, peroxide fractions of Los Angeles smog, and have been unable to induce any checking of rubber on exposure to this material.

3:35 p.m.—**18. Crack Depth Analysis of Ozone Cracking Results.** J. S. Rugg, Gates Rubber Co., Dencer, Colo.

Much attention has been focused in the last few years on the weathering resistance of rubber and synthetic polymers. Accelerated tests to dermine the weathering and ozone resistance of these materials are rapidly coming into regular use. A major deterrent to wider use of this type of test and to complete utilization of weathering and ozone results is the lack of a satisfactory method of analyzing the data obtained.

There are many ways of analyzing the results of ozone and weathering tests; however, two are in common use today. The time to initial cracking is determined visually, and photographs are made at certain time intervals for visual examination. The methods of ozone crack analysis now in use suffer from one or two disadvantages. They usually depend upon human judgment to determine the magnitude of test results, or method and equipment required to obtain data are too cumbersome to permit use in every-day testing.

An ideal method of ozone crack analysis is one which yields quantitative numerical results, is easily performed, does not require specialized or elaborate equipment, and is independent of human error. Such a method is proposed in this paper.

A study was made of the change of the three ozone crack dimensions — crack length, depth, and number — with many conditions of exposure. This study shows that crack depth is a reliable index of the extent of cracking which takes place, and it is the easiest of the three dimensions to measure. The crack depth may be plotted and used quantitatively as other experimental data are used.

Measurement of crack depth is accomplished using a microscope of low power having a graded scale included in the field. A sectioned sample is examined by scanning the entire length, and the longest cracks are considered.

To demonstrate the usefulness of this method separate studies were made of the variables commonly associated with ozone testing. Many of these variables have been reported previously in the literature, but have not had the benefit of quantitative data. This paper shows the effect on crack depth of ozone concentration, exposure time, sample elongation during exposure, constant load during exposure, and constant deflection during exposure. The use of the crack-depth analysis method in the

above studies resulted in quantitative data which are easily plotted and which show clearly the effects obtained.

The method of analysis presented in this paper has proved very useful in performing studies of both ozone and weathering resistance, and this method provides a reproducibility of results between separate tests and between different examiners which has been unobtainable in the past. This method is especially suited to compounding studies of ozone cracking because it shows, quantitatively, the difference between samples being independent of human judgment. This method is proposed for examination by others in the field as a means of improving ozone testing and making the results more reliable.

3:55 p.m.—**19. The Effects of Temperature and Elongation on the Cracking of Rubber and GR-S in Ozone.** G. R. Cuthbertson and D. D. Dunnom, U. S. Rubber, Detroit

Determinations of the effects of elongation on the character of cracking in samples of rubber exposed to ozone have been reported by some of the early workers in the field. Some effects of temperature on the rate and the character of cracking have also been reported; however, these data have not clearly shown the effects of the interaction of temperature and elongation on the character of ozone cracking.

In the present study, samples of natural rubber, standard GR-S, and low temperature GR-S compounds were exposed to a constant concentration of ozone for four hours at several elongations and temperatures. Prints were made from the exposed samples by inking the sample surface and taking an impression on paper.

It was found that the natural rubber compound cracked at lower temperatures and elongations than either the standard or low temperature GR-S compounds. In addition, for each compound, it was found that for each temperature there existed an elongation below which no cracking occurred; this elongation is termed the "cracking threshold" for this temperature. The cracking threshold was found to be a function of the temperature, decreasing with increasing temperature. Although this relation is particularly difficult to treat exactly, since the samples were exposed under non-equilibrium conditions of stress, it is possible to explain this effect on the basis of changes in stress and ozone reactivity with temperature.

It is felt that studies of the effects of compounding on the cracking threshold may be of great value in designing compounds to fit the climatic conditions where they are to be used.

4:15 p.m.—**20. Ozone and Sunlight Aging Studies of Carbon Black Vulcanizates.** G. E. Popp and L. Harbison, Phillips Chemical Co., Akron, O.

The economy resulting from marketing unwrapped rubber products, induced by material and manpower shortages during World War II, provided an incentive in post-war years to continuation of this practice by rubber manufacturers. As high finished product inventories accumulated, the rubber technician became confronted with a cracking condition created by ozone attack when a surface of the unwrapped product was exposed under stress. This situation plus the advent of the synthetic butadiene-styrene polymers and high-structure furnace-type blacks which were developed during the past decade precipitated several investigations to determine relative ozone resistance characteristics.

The theory was advanced by some rubber technicians that the high modulus furnace blacks were conducive to greater checking and ozone cracking characteristics when compared to conventional gas carbon blacks which exhibit lower modulus properties. Hence this study was initiated about one year ago to determine the effects, if any, of individual types of carbon blacks on checking and ozone cracking of natural and synthetic rubber under static testing conditions.

The work reported in this paper represents sunlight and ozone exposure (static) testing of natural crude and low temperature polymer with and without antioxidant in typical tire tread vulcanizates. A comparison of HAF, EPC, MAF, HMF, and SRF types of blacks is made. Specimens were exposed to sunlight aging in Akron during April and May of 1950 under 12½% stress, and an additional series of specimens was simultaneously tested with a 180-degree bend. Germicidal lamps enclosed in a specially prepared cabinet were used for the ozone investigation, and a like series of specimens was exposed for comparison with the weather aging results.

The results show that carbon blacks, regardless of type, particle size, structure, and physical properties imparted, do not affect the rate or degree of cracking in the polymers studied upon exposure to either sunlight or ozone when under static stress.

4:35 p.m.—**21. Ozone Resistance of Neoprene Vulcanizates.** Effects of Compounding Ingredients. D. C. Thompson, R. H. Baker, R. W. Brownlow, du Pont.

The increased use of elastomers in applications involving exposure to ozone has resulted in greater interest in the factors influencing deterioration due to such exposure. Comparative tests have established the superiority of neoprene vulcanizates over those of other elastomers with respect to ozone resistance. Atmospheric ozone encountered during outdoor weathering has a negligible effect on neoprene vulcanizates. Resistance of neoprene vulcanizates to the high concentrations of ozone near electrical discharge systems is also outstanding.

The results reported in this paper show that properly compounded neoprene vulcanizates have excellent resistance to concentrations of ozone as high as 100 to 150 ppm. It is shown that the selection of compounding ingredients is a more important factor in developing resistance to ozone at high concentrations than it is at the low concentrations normally found in the atmosphere. The effects of amount and type of loading; softener, extender, or plasticizer; antioxidant; accelerator; and other compounding ingredients have been studied.

Factors influencing the results of ozone exposure tests are: (1) the conditioning of samples prior to testing; (2) the number and the type of samples present in the ozone chamber; (3) the continuity of the test; (4) ozone concentration; (5) temperature of test; and (6) constancy of strain *vs.* constancy of stress. Accelerated ozone testing should be considered as indicative rather than as an absolute measurement of resistance to attack.

Various carbon blacks and mineral fillers have been studied. Although no definite order has been established, it appears that those fillers known to have a large particle size impair resistance to attack by ozone. Increased loading with the fillers studied generally decreases ozone resistance although this observation is obscured by the effect of the increased loading on the stress-strain characteristics of the vulcanizate.

Some plasticizers and softeners improve, and some impair the ozone resistance of neoprene vulcanizates. Certain vegetable oils, esters derived from vegetable oils, and softeners of the polymeric type improve the ozone resistance of neoprene vulcanizates. Conventional liquid plasticizers generally lower the ozone resistance of neoprene vulcanizates. Most ester plasticizers of the type used to provide flexibility at low temperature impart lower ozone resistance than the petroleum based type. Tributoxy ethyl phosphate is an example of a plasticizer particularly deleterious to ozone resistance. Differences in the effects of plasticizers become greater as ozone concentration is increased.

Antioxidants, which inhibit flex cracking, provide superior ozone resistance in neoprene vulcanizates. Di-para-methoxydiphenylamine and diphenyl-para-phenylene diamine are outstanding examples. Many other antioxidants have been studied and found to provide varying degrees of protection. Increasing the amount of antioxidant results in increased ozone resistance. There are indications that certain of the non-discoloring types impair ozone resistance.

The effect of state of cure and type of accelerator used on the ozone resistance of Neoprene Type GN and Type W vulcanizates has been found to be of a relatively minor importance in comparison to the other variables studied.

5:30 p.m.—**Suppliers' Cocktail Party.** East Room, Commodore Hotel.

7:00 p.m.—**Division Banquet.** Main Ballroom, Commodore Hotel. **Presentation of Goodyear Medal to W. C. Geer.**

FRIDAY MORNING—SEPTEMBER 7
Main Ballroom—Commodore Hotel
Symposium on Preparation and Properties of Synthetic Rubber
I—Preparation.
W. B. Reynolds, Presiding

9:00 a.m.—**22. Introductory Remarks.** J. H. Fielding and W. B. Reynolds.

9:05 a.m.—**23. A Review of Important Polymerization Processes.** R. L. Bebb, Firestone Tire & Rubber Co., Akron.

This paper comprises a general review of important polymerization processes useful for the preparation of synthetic rubber. Emphasis is placed upon emulsion polymerization systems such as (1) persulfate-mercaptan, (2) redox, (3) peroxamine, (4) MDN-ferricyanide, and others. The functions of various recipe ingredients such as emulsifiers, initiators, and modifiers are discussed. Brief discussions of such mass polymerization systems as (1) sodium catalyzed, (2) Alfin, and (3) cationic catalyzed are included. The present and potential importance of various methods for synthetic rubber preparation are assayed.

9:35 a.m. — **24. Viscosity-Conversion Relationships in Sulfur-Modified Polychloroprenes.** W. E. Mochel, du Pont.

The solution properties, gel content, and intrinsic viscosity of sulfur-modified polychloroprenes have been examined as functions of conversion to obtain information about the mechanism of sulfur modification and about the changes that occur during polymerization. Although soluble, plastic polychloroprenes, such as Neoprene Type GN and Type CG, have long been prepared by the polymerization of chloroprene containing small amounts of sulfur and treatment with tetraethylthiuram disulfide, little was known about the mechanism of this "modification."

It has been found that sulfur-modified

polymers isolated at conversions beyond about 10% in polymerizations carried out at 40° C., or beyond 40% in polymerizations at 10° C., are largely insoluble before treatment with an alkaline emulsion of tetraethylthiuram disulfide. After treatment with the thiuram, however, the sulfur-modified polychloroprenes are soluble at conversions up to 90-95%. When the sulfur modifier is omitted, the polymers are insoluble even after treatment with the thiuram. These results, in confirmation of earlier results with radiosulfur, indicate that the sulfur modifier does not act as a chain transfer agent in chloroprene polymerization. The sulfur appears to introduce a linkage into the molecule which can be cleaved by a reaction involving tetraethylthiuram disulfide to convert insoluble cross-linked polymer into soluble material.

The intrinsic viscosities in benzene of sulfur-modified, phenyl-alpha-naphthylamine-stabilized samples from polymerizations at 10° C. have been found to rise rapidly with increasing conversion to about 40% and then fall as gel separates. The gel point of a corresponding polymerization at 40° C. appears to be below 10% conversion. When the sulfur-modified polychloroprenes are treated with tetra-ethylthiuram disulfide before coagulation, the intrinsic viscosities of the polymers made at 10° C. and at 40° C. follow approximately the same course. The viscosity increases to a maximum at conversion of 18-20% and then decreases and remains relatively constant from approximately 30 to 80% conversion. At 85-90%, particularly for polymerization at 40° C., there appears to be a second, but smaller maximum in the intrinsic viscosity-conversion curve.

The first peak in the viscosity curve is believed to be caused by a change in polymer structure resulting from increasing amounts of branching and/or cross-linking leading to a different axial ratio and, therefore, a different molecular weight-intrinsic viscosity relationship. Calculated partial conversion-intrinsic viscosities are in accord with this hypothesis. The possibility of changes in the amounts or types of sulfur linkages must also be considered. The second peak results from the formation of relatively tightly gelled network polymer that cannot be solubilized by treatment with tetraethylthiuram disulfide.

9:55 a.m.—**25. Polymerization Rates in Emulsion Systems** M. Morton, P. P. Salatiello, H. Landfield, University of Akron, Akron.

A study has been conducted on the emulsion polymerization of butadiene, isoprene, and styrene, using several different catalyst systems, with a view to relating the rate of polymerization to particle size and number.

According to theory, the rate should be directly proportional to the number of particles and independent of all variables other than temperature. While this has been found to be true for styrene with the two catalyst systems tried, it is only partially true for the other two monomers. Both butadiene and isoprene show this "ideal" behavior when the catalyst system is of the hydroperoxide-polyamine type. With the other catalyst systems used, however, these monomers show a rate dependence on the amount of soap adsorbed on the particles.

Hence it is found that the particle size and number in polybutadiene and polyisoprene latex is about the same, whether the polymerization is carried out at low temperatures with peroxide catalysts or at higher temperatures with the Mutual Recipe. Within any given system the particle size is decreased (and the number increased) by higher temperature, increased soap, or increased catalyst charge.

II—Properties
J. D. D'Ianni, Presiding

10:15 a.m.—**26. Introductory Remarks.** J. H. Fielding and J. D. D'Ianni.

10:20 a.m.—**27. Relationship between Molecular Structure and Physical Properties of Synthetic Rubber.** S. D. Gehman.

This review paper seeks to bring together available information on relationships which exist between the most important features of molecular structure and the physical properties of synthetic rubbers. The molecular characteristics of greatest significance for the physical properties are considered to be the nature of the monomer units, molecular weight, cross-linking, details of chain structure such as cis-trans isomerism and side vinyl groups, chain branching, crystallization.

In many experiments observed variations in properties may be dominated by the detail of structure being investigated, but other uncontrolled deviations in structure frequently occur, especially in the course of processing and vulcanization. Thus quantitative correlations of structure and properties are usually possible only under ideal circumstances and very carefully controlled conditions. Nevertheless a large amount of useful information is available for understanding the connections between the molecular structure and the physical properties of the principal types of synthetic rubber. In general, each particular feature of structure exerts its most conspicuous influence on a rather limited group of physical properties. Emphasis is placed on the work done to correlate molecular structure with the properties of vulcanizates compounded for service.

The chemical nature of the monomer units determines the intermolecular forces and influences especially the temperature range in which rubber elasticity is exhibited, the swelling in organic liquids, and the permeability to gases. Molecular weight distribution is most significant for processability. Tensile strength and modulus are sensitive to low molecular weights, but become insensitive to higher molecular weights. Cross-linking in the raw polymer gives rise to gel and affects the processability. The cross-linked network formed upon vulcanization is controlling for the tensile properties and for stability under stress, especially in the absence of crystallization. Regularity in the geometrical form of the chain molecules appears favorable for low hysteresis and conducive to crystallization under stress. This condition leads to improved tensile strength and flex life. Effects of chain branching are rather obscure, but serve to explain variations in properties not otherwise accounted for. These principles are illustrated in detail for various types of synthetic rubber and serve to unify an otherwise bewildering diversity of properties.

10:50 a.m.—**28. Some Effects of Polymerization and Molecular Weight.** J. R. Beatty, B. F. Goodrich Co., Brecksville, O., and B. M. G. Zwicker, B. F. Goodrich Chemical Co., Cleveland, O.

The advantages of 5° C. cold rubber over "hot" GR-S in high black vulcanizates are well established. This paper describes some changes in micro and macro structure observed in butadiene-styrene copolymers made at five polymerization temperatures (−18, −10, 5, 20, and 50° C.) and their relation to changes in vulcanizate properties as a function of polymerization temperature and molecular weight.

The experimental rubbers were prepared so as to minimize variables other than polymerization temperature. Bound styrene was 23%; conversion 60%; and raw Mooney viscosity 48±7 ML. Polymers prepared at three reaction temperatures (50, 5, and −18° C.) were fractionated by precipitation into three molecular weight ranges in sufficient quantity for micro compounding studies.

Raw polymer characterization included molecular weight distribution by fractional precipitation, configuration of polymerized butadiene by infrared, micro homogeneity by crystallization, and gellation tendency with hot air. Vulcanizates were evaluated in high and low hardness recipes for the usual rubber properties and also in detail for crystallization tendency and dynamic properties. Commercial GR-S and cold rubber were included as controls.

It was concluded that the major differences in polymer structure of cold rubber as compared with GR-S are: (1) a narrower molecular weight distribution with less soupy polymer, (2) an increase in crystallization tendency, and (3) an increase in homogeneity of the polymer composition. Improvement in vulcanizate properties of stress-strain and resilience with reduction of polymerization temperature from 50 to 5° C. was proportionately much greater than that resulting from further reduction to −18° C., correlating well with crystallization tendency of the vulcanizate at −25° C., but not with the increase in homogeneity of the polymer composition.

Reduction in the amount of low molecular weight polymer softener in cold rubber, as compared with GR-S, increases its sensitivity to hot aging and changes the shape of its modulus cure curve. Actual processability is much better than a hot GR-S made with the same tertiary mercaptan modifier. Evaluation of vulcanizates of fractionated polymers showed a marked decrease in hysteresis loss as molecular weight increased. There was a simultaneous increase in dynamic rate or modulus, but the product, as measured by temperature rise, decreased with increasing molecular weight in nearly all recipes.

11:10 a.m.—**29. Viscosity—Molecular Weight Relation for Polybutadiene. II.** Effect of Polymerization Conditions Which Influence Branching and Cross-Linking. B. L. Johnson and R. D. Wolfangel, Firestone.

The changes in polymer structure which result from variation in polymerization temperature have been shown previously to influence the relation between intrinsic viscosity and molecular weight. The exponent of molecular weight, in particular, was found to increase as polymerization temperature was lowered. Similar increase in viscosity per unit molecular weight has been shown by previous authors to be indicative of a more linear, more extended polymer chain. Research of this nature was continued to determine if the change in the molecular weight exponent could be correlated with a particular change in polymer structure.

The exponent "a" in the relationship $[\pi] = KM^a$ was found to decrease as the hydrocarbon conversion of emulsion polybutadiene was increased from 20.5 to 81% at a constant polymerization temperature of 50° C. Values of 0.45, somewhat below the theoretical lower limit of 0.50, were

obtained for the molecular weight exponent at conversions which would normally be considered to be at or beyond the gel point as judged by intrinsic viscosity-conversion curves.

The molecular weight exponent of a series of polybutadienes made with progressively less modifier was also found to decrease as the modifier concentration decreased. Infrared analyses of polymers from these two series indicated no trend in micro-structural changes such as the amount of 1,2 addition or in the cis-trans ratio of the 1,4 adduct with increase in conversion or in modifier level.

On the basis of these results it was felt that branching and cross-linking were the predominant changes in polymer chain structure as conversion progressed, or modifier was reduced. More direct evidence was obtained to substantiate the effect of coss-linking upon the molecular weight exponent by copolymerization of increasing amounts of divinyl benzene with styrene in the GR-S system at 50° C. As the number of divinyl benzene units or potential cross-linking sites per polymer was increased, there was a rapid decrease in the molecular weight exponent from the value of 0.92 obtained for the non-cross-linked polystyrene. This decrease in exponent levels off to a relatively constant value of between 0.5 to 0.4 when the number of divinyl benzene units per molecule exceeds four.

While this method does not provide an absolute means for measurement of cross-linking or branching because the value of the molecular weight exponent for a completely unbranched polymer has not been established, it does make possible the evaluation of cross-linking relative to the gel point. It also indicates that few cross-links are required to reduce the molecular weight exponent of a relatively linear polymer to the lower theoretical limit of 0.5 found at the gel point of polybutadiene. Evidently soluble polybutadiene produced to normal conversion in the GR-S system at or above 50° C. is close to the gel point.

11:30 a.m.—**30. Structure of Alkali Metal-Catalyzed Butadiene Polymers.** A. W. Meyer, R. R. Hampton, J. A. Davison, U. S. Rubber, Passaic, N. J.

Structure determinations by the use of infrared absorption measurements were made on various butadiene polymers and copolymers. The procedure previously reported for emulsion polymers by E. J. Hart, A. W. Meyer, and R. R. Hampton was used for this work.

The polymers, made at the Government Laboratories in Akron, included polybutadiene and butadiene-styrene copolymers. They were catalyzed by sodium, potassium, and equimolar mixtures of sodium and potassium. Polymerization temperatures were varied over the range 5 to 75° C. Pentane, methylcyclohexane, toluene, and xylene were used as diluents. "Modifiers" employed to reduce the polymerization rate were dodecylamine, piperidine, Flexol 4GO, isopropyl ether, and dianisyl disulfide. All the alkali-metal catalyzed polybutadienes had a higher proportion of the butadiene in the 1,2 configuration (45-80%) than the values obtained for emulsion polybutadiene (18-23%). Polybutadienes catalyzed by potassium had 15-20% less butadiene in the 1,2 configuration than those in which sodium was the catalyst. When a mixture of sodium and potassium was used, the results were nearly the same as with the potassium catalyst alone. The butadiene in cis 1,4 and trans 1,4 configurations increased proportionately as the percentage of 1,2 decreased. Sodium catalyzed polybutadienes made at 5° C. had about 15% more butadiene in the 1,2 configuration than those made at 45° C. Potassium catalyzed polybutadienes made at 5° C. had 10% more butadiene in the 1,2 configuration than those made at 45° C.

The diluents and "modifiers" influenced polymerization rates and molecular weights, but had little or no effects on the structure of the polybutadienes. The butadiene-styrene copolymers were found to have the butadiene portion with about the same relative proportions of 1,2 cis 1,4 and trans 1,4 as the butadiene homopolymers.

The second-order transition temperature of sodium catalyzed polybutadiene made at 30° C. was −45° C.; whereas the 75° C. polybutadiene had a value of −64° C.

11:50 a.m.—**31. Polysulfide Polymers—Low Temperature Properties.** E. M. Fettes, J. S. Jorczak, R. L. Knarr, P. E. Meiss, Thiokol Corp., Trenton, N. J.

A systematic survey was made of the effect of structure upon the low temperature properties of polysulfide polymers with the objective of obtaining a polymer superior to that derived from dichloroethyl formal.

Ninety dihalides were obtained or synthesized for this study. The polymerization of these intermediates was carried out in a standard manner to produce high molecular weight polymers. In many cases, reaction conditions had to be varied to produce polymers of sufficient chain length to be capable of evaluation as rubbers.

The main structural variables investigated were length of chain between disulfide groups, types of atoms in chain, and types of side chains. Hydrocarbon chains from methylene through hexamethylene were investigated as well as chains composed of ethylene oxide residues. The replacement of carbon atoms in the chain by oxygen, nitrogen, and sulfur was examined. The effect of various lenghth side chains was investigated by studying the properties of polymers containing alkyl and aryl side groups attached to chain carbon atoms. Also various ethers and esters of 2,3-dichloropropanol were converted into polysulfide polymers to examine the effect of groups linked to the chain through oxygen atoms.

The effect of various amounts of tri- and tetrafunctional cross-linking agents was examined. The effect of varying amount (rank) of sulfur combined in the polymer was also studied.

The high molecular weight polymers were converted to crude rubbers with terminal thiol groups by standard techniques. The rubbers were compounded and cured in a standard formulation. The effect of curing agent and type and amount of loading on low temperature properties was also determined.

The vulcanizates were subjected to physical testing. The main dependence for evaluation of low temperature properties was on a torsional modulus test, but low temperature compression set was also measured. Volume swell in SR-6 and in water was determined on all polymers.

Although no one monomer gave a rubber superior to that from dichloroethyl formal, a number of copolymers of that dihalide were found significantly better in low temperature flexibility.

FRIDAY AFTERNOON—SEPTEMBER 7
Main Ballroom, Commodore Hotel
Symposium on Latex
L. A. Wohler, Presiding

2:00 p.m.—**32. Introductory Remarks.** J. H. Fielding and L. A. Wohler.

2:05 p.m.—**33. Review of Recent Progress in Latex Technology.** E. A. Murphy, Dunlop.

The paper is concerned mainly with recent progress in the technology of natural latex with briefer reference to synthetic latices. Advances in the production of latex concentrates are outlined, also progress reported in the partial replacement of ammonia as a stabilizer. Reference is made to the electro decantation process and the nature of the concentrate produced.

Recent work on the constitution of natural latex is discussed, also progress made in modifying stability and other properties of latex concentrates to render them suitable for special applications.

The established methods of evaluating the chemical and physical properties of latex are outlined, and the relative abilities of these tests to indicate the behavior of the latex in various processes discussed. Newer methods of testing and their applications are also described.

Some of the more important advances in the manufacture of latex products are touched upon, and comments are made on the future trends of research and development in the latex industry.

2:40 p.m.—**34. Latices of Flexible Synthetic Polymers.** B. M. G. Zwicker, Goodrich Chemical.

During the past 10 years there has been rapid progress in manufacture and use of flexible synthetic polymers. The merits of water based systems have been well recognized, and there are now nearly 200 synthetic rubber, plastic, or plasticizable polymer latices commercially available in the United States. These uncompounded products of more than 30 manufacturers have been grouped into 15 classes according to reported polymer composition (five types of rubbers and 10 types of plastics).

General properties of synthetic latices are discussed. These include (1) the effect of particle size on stability and viscosity; (2) characteristics of typical emulsifiers, dispersing and thickening agents, and their influence on stability, coagulation, and application; and (3) wet and dry film strength properties of typical synthetic polymers.

Each class of polymer is discussed with reference to inherent polymer properties and how these are related to principal applications. Good heat, light, and air aging, as well as chemical, oil, grease, and solvent resistance are characteristics of more than half the commercial materials. Most synthetic polymers possess substantially higher modulus and less tack than *Hevea* latex. Water resistance, adhesive and cohesive properties, flexibility, and thermo plasticity can be selected over wide ranges. Many polymers contain polar or chemically reactive groups that impart affinity for cellulose, metals, or other structural materials. These and other specific properties have resulted in many improved or new products in the fields of adhesives (structural, temporary, laminating, fiber, and pigment), surface coatings, supported film, unsupported film, foamed sponge, and coagulant dipped or molded articles. Certain deficiencies in existing materials are pointed out.

New products entering the market include water dispersable polymers (for hydrosols), water soluble polymers (poly electrolytes and hydrophillic compounds) and plastisols (resins dispersed in plasticizers). These are not discussed in detail, but specific advantages over latex systems

are mentioned. Water dispersable thermosetting resins have not been considered except as compounding ingredients.

3:00 p.m.—**35. Some Factors in the Prevulcanization of Latex.** H. B. Townsend, P. G. Cook, P. A. Coffin, General Latex & Chemical Corp., Cambridge, Mass.

Dr. Phillip Schidrowitz of London discovered in the mid '20's that latex can be prevulcanized without coagulation. In the elapsed years this idea has proved of major utility to the latex industry. Currently the bulk of all latex used is believed to involve, in a modern form, the prevulcanization techniques first taught by Dr. Schidrowitz.

Four interrelated steps are of major importance in commercial usage of latex prevulcanization techniques: (1) stabilization of the latex involved, (2) selection of vulcanizing ingredients, (3) dispersion of the compounding selection, and (4) the methods of forming sulfur or equivalent linkages.

The paper outlines some of the methods of selecting or modifying a latex to be prevulcanized. Some such test methods relate to colloidal adsorption properties as reflected in changes in stirability, or solvent drop tests. Other tests relate to specific reactivity toward vulcanizing ingredients with special detail given to studies of the reactivity of a latex toward zinc oxide. From the results of such control tests it has been found commercially feasible, if desired, to subject compounded latex to temperatures even above the boiling point of water and also to moderate agitation simultaneously.

Methods of following the changes developed from sulfur linkages, such as chloroform coagulation, toluol swelling tests, and T-50 methods, are discussed.

A study has been made of the aspects of vulcanization in the "maturing" step involved in the manufacture of latex foam. This step is shown by data to conform to a prevulcanization initiation, and its course is followed by measurement of swelling coefficients as functions of time and compounding ingredient selection.

3:20 p.m.—**36. Physical Properties of Films from Mixtures of Natural and Synthetic Rubber Latex Blends.** R. M. Pierson, R. J. Coleman, T. H. Rogers, Jr., D. W. Peabody, J. D. D'Ianni, Goodyear.

Synthetic butadiene-styrene copolymer latices were prepared for evaluation of their film vulcanizate properties, both alone and in blends with natural rubber. The effects of the following polymerization variables were studied: (a) polymerization temperature; (b) degree of conversion, over range 25-95%; (c) latex particle size as polymerized; (d) butadiene/styrene ratio, in range 100/0 to 50/50; (e) plasticity, in range of Mooney (small rotor) 25 to 100.

Most of the present study of polymer variables has been made on compounded natural-synthetic blends cast as unloaded latex films and vulcanized in an air oven. Some comparisons were made with similar compositions which were mill-mixed and press-cured, or were latex cast and press-cured without mixing. Stress-strain characteristics and low temperatures behavior have been the principal properties determined on the films.

For a given polymerization temperature and charge ratio, the conversion of the synthetic latex appears most important in determining its value as an extender for natural latex. For example, a 60% conversion Type V, GR-S latex has considerably better stress-strain properties in 50/50 to 10/90 synthetic/natural ratios than does Type V polymerized to the usual conversion (95%). Above 60% natural rubber the properties of the blends approach each other so closely that the differences are indistinguishable.

The synthetic latices prepared at low temperature (41° F.) gave blends with stress-strain properties superior to those of comparable high temperature (122° F.) polymers. Also, the low-temperature flex properties of the blends were superior for the latices reacted at low temperature.

Increasing the styrene content had favorable effects on stress-strain properties and deleterious effects on low temperature properties, in accord with observations of other workers. Increasing the Mooney viscosity improved stress-strain properties when such increases resulted from an increase in the average molecular weight of essentially soluble or loosely cross-linked polymer, but not when the increase was due to the presence of tight gel.

Latices of small particle size agglomerated to a large particle size prior to blending gave properties essentially the same as those of latices whose large size was attained in the reactor.

3:40 p.m.—**37. Water Vapor Permeability and Sorption of *Hevea* Latex Films.** W. W. Bowler, Firestone.

It is well known that a considerable structural difference exists between *Hevea* latex films vulcanized after drying and similar films when vulcanized in the latex state. Since these two types of films differ considerably in water vapor permeability and sorption, a careful study has been made of these phenomena with the hope of throwing some light on the question of film structure.

Using the cup method, an investigation was first made of the variables in the permeability equation,

$$Q = \frac{P \; A.t. \; \Delta p}{x}$$

where Q is the weight of water vapor passing through the area; A, of a film of thickness x in time t; Δp is the vapor pressure difference; and P is the constant of proportionality called the permeability constant. It was found that, following the above equation, the weight of water permeating through an uncompounded film is inversely proportional to the thickness of the film over a wide range of thicknesses and directly proportional to the vapor pressure difference except at very high values of Δp. This was not true for films vulcanized in the latex state.

An investigation of the relation

$$C = S p$$

where C is the weight of water sorbed per unit weight of rubber, p is the aqueous vapor pressure, and S is the sorption coefficient, revealed that this sorption equation is followed only by films vulcanized in the latex state at low values of p. Films cast from vulcanized latex were found much more permeable to water vapor, to sorb considerably less water, and to have a greater negative temperature dependence of permeability than uncompounded or dry vulcanized films. The effect of various compounding agents and of film stretching upon permeability was determined.

It is concluded from these experiments that diffusion of water vapor takes place primarily through void spaces in wet-vulcanized films, and through rubber polymer or through the adsorption layer by continual adsorption on and desorption from active centers present in the hydrophyllic surface material in uncompounded and dry vulcanized films. Both processes, diffusion through rubber polymer and through the adsorption layer, can be considered as an activated diffusion. The question of whether the strength of wet-vulcanized films depends upon secondary van der Waals forces or upon primary sulfur linkages between the particles is briefly discussed.

4:00 p.m.—**38. Mechanical and Chemical (Zinc Oxide) Stability Tests.** C. O. Miserentino, Dunlop Tire & Rubber Co., Buffalo, N. Y.

There is some question as to whether the present generally accepted methods for determining the mechanical and chemical (zinc oxide) stability of latex give a complete accurate index of the stability under conditions that prevail in ordinary handling operations.

This test requirement is met by a method based on the volume/time froth curve produced on whipping a known amount of latex of normal operating concentration and controlled temperature at a constant speed.

Experimental results reported in this paper show:

1. A method for measuring the mechanical and chemical (zinc oxide) behavior or stability of latex, the results of which have a direct bearing on possible practical applications of the latex being tested.

2. That the volume/time curve permits a qualitative or quantitative characterization of each portion of that curve, which may in turn be expressed as low, moderate and/or high rate of rise, stability end point and rate of froth drop.

3. That destabilization or change in slope of the volume/time curve takes place before the occurrence of visual agglomerated rubber particles, thus defining the stability end point as that point at which a change in slope of curve occurs.

4. That the so-called mechanical or chemical stability end point is not a complete criterion in itself. It may be considered only as contributing characteristic factor in conjunction with the rate of rise (stabilization—volume/time curve) and the rate of drop (destabilization—volume/time curve).

4:20 p.m.—**39. Studies on the Yellow Fraction of Latex.** G. E. van Gils, Indonesian Rubber Research Institute, Bogor, Indonesia.

Further studies on the yellow fraction of fresh *Hevea* latex[4] show that the so-called lutoids are redispersed after ammoniating fresh latex and that the dissolution, previously assumed, occurs only partially. Besides the rubber phase it is concluded, therefore, that another phase also contributes to the viscosity of ammoniated latex.

The lutoids also dissolve partially by addition of monovalent salts, and from this work it is suggested that a portion of the yellow fraction consists of a complex coazervate (liquid precipitated from an emulsion). Experiments in connection with this partial separation of the yellow fraction of latex are described, and their technological importance, for example in the manufacture of latex crepe, are discussed.

4:40 p.m.—**40. GR-S Latices in Foamed Latex Rubber.** L. Talalay, Sponge Rubber Products Co., Shelton, Conn.

The advent of low temperature polymerization with the resultant improvement in the pure gum strength of GR-S latices has

[4] "Proceedings of the Second Rubber Technology Conference," pp. 292-302. Edited by T. R. Dawson. W. Heffer & Sons, Ltd., Cambridge, England.

made possible the production of serviceable all GR-S foamed latex rubber.

A study was undertaken to evaluate the physical properties of GR-S foamed rubber made from LTP latices of varying polymerization recipes. The effects of butadiene/styrene ratio, Mooney viscosity, conversion, and temperature of polymerization were investigated. The physical properties evaluated included: foamed rubber tensile and elongation, modulus of compression, flexibility at sub-zero temperatures, rebound elasticity, and flex life.

Slab foamed rubber samples of all polymers were prepared using the method of U. S. patent No. 2,432,353. *Hevea* foamed rubber was the standard of comparison.

Both tensile and elongation of foamed rubber made from 41-50° F. GR-S were found to be five times those of foamed rubber made from GR-S polymerized at 122° F. Tensile of LTP GR-S foamed rubber (at 26% bound styrene) is better than 50% of the tensile of *Hevea* foamed rubber, which is contrary to results indicated by film data. Of several film techniques investigated a "rolled ring" method gave best results. In better agreement with film data, the elongation at break of LTP GR-S is at least two-thirds that of *Hevea*.

Lower temperature of polymerization of GR-S also results in foamed rubber with improved rebound elasticity to the point of closely approaching that obtained with *Hevea*. Rebound was measured in vacuum in order to minimize pneumatic effects.

Reducing bound styrene in polyamine activated 41° F. GR-S latex from 26 to 0%, by steps, results in a linear decrease in foamed rubber tensile, aggregating to 30%, while no effect upon elongation and rebound at room temperature was observed.

Styrene content has a profound effect upon the flexibility of GR-S foamed rubber at —40° F., and even more so at —70° F. A very pronounced optimum exists at approximately 11% bound styrene.

A clearcut relation appears to exist between the compression modulus of foamed rubber and the Mooney viscosity of the polymer. For example, the resistance to compression doubles when Mooney viscosity (ML-4) is increased from 36 to 150.

Polymerization conversion between 50 and 80% has little effect upon the properties of the resultant GR-S foamed rubber.

In both LTP GR-S and *Hevea* foamed rubber increased sulfur ratios result in improved modulus, low-temperature flexibility, and rebound, while the elongation decreases. A notable difference is that the tensile of *Hevea* foamed rubber deteriorates while the tensile of LTP GR-S foamed rubber improves slightly with increasing sulfur content.

The colloid chemical system of the polymer latex enters directly into the problems of foamed rubber manufacture. Some of the limitations imposed by this fact upon polymerization recipes are discussed.

Panel on Bonding

A PANEL discussion on rubber to metal bonding featured the April 10 meeting of the Los Angeles Rubber Group, Inc., held at the Hotel Mayfair, Los Angeles, Calif., with 206 members and guests present. Members of the panel at the discussion, held during the afternoon technical session, were Franklin J. French, Kirkhill Rubber Co.; T. A. Reynolds, Stoner Rubber Co.; Fred T. Schor, MacClatchie Mfg. Co.; and John Akers, Goodyear Tire & Rubber Co. A transcript of the discussion will be available later.

The technical session was followed by a cocktail hour and dinner, after which Therodore Hsi-En Chen, University of Southern California, spoke on "China and the Far East." Dr. Chen said that the real reasons for the fall of the Nationalists in China were the lack of food, high taxes, and war. These conditions are again existing under the Communist government, and evidence of feeling against the regime is shown by reports of purging.

Door prizes distributed at the meeting were won by Ira Frazier, Bettis Rubber Co.; Bud Crawford, Naugatuck Chemical Division, United States Rubber Co.; E. C. Scott, Firestone Tire & Rubber Co.; R. N. Phelan, Atlas Sponge Rubber Co.; Clyde Moulton; J. H. McSparran, C. P. Hall Co. of California; Glen Dunbar, Caram Mfg. Co.; J. Jorczak, Thiokol Corp.; Case Preston, Xylos Rubber Co.; and R. H. Stewart, Dow Corning Corp.

Hear Talk on Antioxidants

Approximately 246 members and guests of the Group attended a meeting on May 1 at the Hotel Mayfair. The afternoon technical session was highlighted by a talk on "Antioxidants for Natural and Synthetic Rubbers" by Arnold R. Davis, American Cyanamid Co.

Mr. Davis said that hundreds of different chemicals have been patented since 1924 for preserving or extending the life of vulcanized rubber. These materials can be divided into two groups: (1) age resisters, a general term for materials that protect rubber; and (2) antioxidants, materials which specifically retard oxidation and prevent rubber from the deteriorating effects of oxygen.

While some 50 different antioxidants are commercially available, these may be grouped in the following classifications: (1) aldehydeamines; (2) ketone-amine reaction products and the secondary amines, including secondary aromatic amines, and secondary alkyl-aryl amines; (4) primary aromatic amines; (5) phenols; and (6) phenol-amine salts. The ketone-amine reaction products and the secondary amines, particularly the secondary aromatic amines, are used in the greatest total volume.

Mr. Davis discussed the chemistry and compounding properties of the more common commercial antioxidants in each of the classifications. The phenols are a new class of antioxidants that vary in activity from slight to very good and give varying degrees of discoloration from practically none to moderate in white rubber stocks exposed to light.

Speaker at the dinner meeting, which was the Plastic & Rubber Products Co. night, was Wm. H. Parker, chief of the Los Angeles Police Force, who gave a dynamic and inspiring talk. Entertainment was provided during the dinner, and the meeting closed with a drawing for prizes won by J. P. Ballesio, Firestone; A. J. Falkenberg, American Mineral Spirits Co.; Mr. Everett, U. S. Rubber; Phil Cable, Goodyear; and Arch Robinson, Los Angeles Standard Rubber Co.

Golf Tournament

Approximately 39 members and guests of the Los Angeles Rubber Group, Inc., participated in a golf tournament on April 13 at the San Fernando Valley Country Club. Prize winners in the competition follow: blind bogey, S. M. Freeman, Witco Chemical Co.; low net, Joe Hoefle, Plastic & Rubber Products; fewest total putts, W. A. Fairclough, Naugatuck Chemical; low gross, Wade Wiley, Goodyear; closest tee shot at fifteenth hole, H. W. Baker, Dill Mfg. Co; longest drive, R. W. Johnson, Rubber Products, Inc.; longest putt, H. W. Franklin, Stillman Rubber Co., Inc.; and most trap shots, J. J. Tyner, Dow.

Special-Purpose Rubbers

SOME 112 members and guests of the Philadelphia Rubber Group attended a dinner meeting on May 11 at the Poor Richard Club, Philadelphia, Pa. Featured speaker was Roger C. Bascom, B. F. Goodrich Chemical Co., on the subject, "Special-Purpose Rubbers."

Mr. Bascom defined special-purpose rubbers as vulcanizable elastomers that provide some function that natural rubber does not perform, which are used for applications other than tires and tubes. The speaker noted that most published work and advertisements by polymer manufacturers stress the advantages of their product, but do not provide comparative data which point out the limitations and virtues of all the special-purpose rubbers.

The various types of special-purpose rubbers were discussed by Mr. Bascom with regard to composition, properties, physical forms, trade names, and applications. Polysulfide rubber possesses extreme resistance to aromatic oils and fuels and lacquer solvents and is used for hose tubes and, as liquid polymers, for sealants and slush molding compounds. Polychloroprene has fair oil resistance and compression set and the best gum tensile and resilience of any synthetic rubber and is used for hose covers, wire and cable jackets, and miscellaneous mechanical uses where moderate oil resistance is needed.

The properties of nitrile rubbers vary with the ratio of acrylonitrile and butadiene; high acrylonitrile content gives high tensile, abrasion, and oil and solvent resistance; while lower acrylonitrile content decreases these properties, but improves low temperature flexibility and resilience. These rubbers are used where high abrasion, excellent water resistance, and outstanding oil resistance are required and are also used to blend with and modify resins. High styrene-butadiene rubbers are used as reinforcing resins for other rubbers; while the latices are utilized as pigment binders in coatings.

Butyl rubber provides outstanding ozone and aging resistance, and impermeability to gases, and is used mainly for inner tubes. Silicone rubbers provide a very wide service temperature range, but have relatively poor physical properties that may be improved by future developments. Polyacrylic ester rubbers are quite new, have excellent ozone and aging properties, but relatively poor low temperature properties. They are of interest primarily for hot oil service.

Mr. Bascom said that work on synthetic rubbers is aimed at developing a polymer with the temperature range of silicones, the resilience of natural rubber, the oil resistance of the polysulfides, and the sunlight and ozone resistance of neoprene, yet be made in large volume from inexpensive raw materials. While such a single rubber will probably never be made, some of the research will result in new polymers that will bridge the gaps now existing.

Treichler on Fungicides for Rubber and Plastics

A TALK on "The Application of Fungicides to Rubber-Like Polymers and Related Materials," by Raymond Treichler, Chemicals & Plastics Section, Office of the Quartermaster General, featured the May 11 meeting of the Connecticut Rubber Group. Approximately 75 members and guests met in the auditorium of United Illuminating Co., New Haven. In a brief business session preceding the talk, Dave McKean, Whitney Blake Co., was appointed chairman of the outing committee.

Dr. Treichler stated that vulcanized natural rubber, GR-S, neoprene, butyl, "Thiokol," and nitrile rubber are relatively free from fungus attack. What fungus growth that does occur is caused by surface contamination or occlusion of vulnerable material. There is no need for inclusion of fungicidal agents in rubber to protect against loss of mechanical properties.

Synthetic resins such as polyethylene, polymethyl methacrylate, polystyrene, polyvinyl acetate, polyvinyl chloride, phenol-formaldehyde, melamine-formaldehyde, and urea-formaldehyde are also resistant to fungi. However the use of cellulosic fillers or laminates and oil-based plasticizers in these resins may necessitate the use of fungicides for maximum protection. Phthallic acid and phosphoric acid derived plasticizers are generally resistant to fungus attack. Base fabrics of cotton or rayon must be impregnated with a suitable fungicide to provide maximum retention of tensile strength in tropical areas. In conclusion, the speaker said that suitable rapid preliminary screening methods have been developed, and practical testing procedures established, for evaluating mildew resistance of varying classes of plastic films and coated fabrics.

Washington Group Reports

NEW officers of the Washington Rubber Group for 1951-1952, elected by recent mail balloting, were announced at the May 22 meeting, held at the Cosmos Club, Washington, D. C. The new officers follow: president, T. R. Scanlan, Gates Rubber Co.; vice president, Norman Bekkedahl, National Bureau of Standards; secretary, Gerald P. Reinsmith, Office of the Chief of Army Ordnance; treasurer, Philip Mitton, Army Engineers Research and Development Laboratories; and recording secretary, Miss Ethel Levene, Navy Bureau of Ships.

Some 90 members and guests were present at the meeting, presided over by Mr. Scanlan in the absence of President Warren Stubblebine, Army Quartermaster Corps. Mr. Scanlan announced that the A. C. S. has appointed Dr. Stubblebine as chairman of the local arrangements committee to celebrate the seventy-fifth anniversary of the Society by appropriate ceremonies in Washington during the first week of September. Membership Chairman T. A. Werkenthin, Navy Bureau of Ships, reported that the Group now has 321 members. Current Secretary Richard Harmon, Connecticut Hard Rubber Co., reported that an up-to-date roster of the membership will soon be available for distribution.

Featured speaker at the meeting was Hubert D. Harris, Gates Rubber, who discussed "Trends of Textile Demands by the Rubber Industry." Mr. Harris' talk covered the comparative properties of both natural and synthetic textile fibers of interest to the rubber industry. The rubber industry is being challenged by the multitude of fibers now available. Each fiber must be used differently in a product because fibers differ in moduli, fatigue and growth qualities, adhesive properties, and adaptability to a production line.

At the April 24 meeting of the Group, also held in the Cosmos Club, John T. Blake, Simplex Wire & Cable Co., spoke on "Rubber in Electrical Wire and Cable." He predicted that the wire and cable industry will use substantially 100% synthetic rubber in its products. Synthetic rubber has revolutionized the industry and permitted the manufacture of more serviceable products than could be made with natural rubber alone.

In reviewing the performance of synthetic rubbers in the wire and cable industry, the speaker pointed out that ability to withstand installation and service hazards is the property most in demand. The more commonly used criteria of tensile strength and elongation are of relatively little significance. The important physical properties are resistance to aging at high temperatures, ozone resistance, low water absorption, low temperature flexibility, and good electrical qualities.

While neoprene is now the preferred material for jacketing, GR-S is the primary rubber used in wire insulations, Dr. Blake said. Butyl, however, is proving a most desirable material for insulation because of its inherent resistance to degradation by heat and oxidation.

A talk on "Gum Plastics" by Sidney M. Cadwell, United States Rubber Co., highlighted the March 27 meeting of the Group at the Cosmos Club. The new family of gum plastics is capable of replacing scarce metals in the expanding mobilization economy, Dr. Cadwell declared. The wide range of properties, of gum plastics not completely shared by either hard or soft rubbers or by conventional plastics, makes it possible for the rubber industry to perform many new jobs and do many old jobs better.

The gum plastics are tough, dimensionally stable, chemically resistant, light in weight, versatile, and, in some cases, can be made flame resistant. In impact strength unreinforced gum plastics compare favorably with light metals and reinforced phenolics, the speaker stated. Gum plastics can be drawn, molded, extruded, and fabricated; have a wide hardness range; and can be made either flexible or rigid. Dr. Cadwell stressed that the gum plastics are not substitutes, but are new materials which can replace older materials in many applications and, at the same time, do a better job.

Detroit Group Hears Vodra

APPROXIMATELY 150 members and guests of Detroit Rubber & Plastics Group, Inc., attended a regular dinner-meeting April 27 at the Detroit Leland Hotel, Detroit, Mich. Speaker of the evening was V. H. Vodra, Wyandotte Chemicals Corp., on the subject, "White Carbon Black—What Is It?" Mr. Vodra's talk dealt with calcium carbonates and their use in rubber and was similar to the talk which he gave before the October 26, 1950, meeting of the Northern California Rubber Group, reported in our December issue, page 331.

Chicago Group Elects

CONCLUDING the current season, the Chicago Rubber Group held a special ladies' night meeting on April 20 at the Morrison Hotel, Chicago, Ill. Approximately 150 members, guests, and their wives attended and were entertained by Prof. Russel Oaks, zany inventor. Prizes were awarded after the meeting.

Announcement was made of the election of the following officers for 1951-1952 by the recent letter ballot: chairman, J. Frank Taylor, Commercial Solvents Corp.; vice chairman, Herman Boxser, Acadia Synthetic Products Division, Western Felt Works; secretary, A. J. Hawkins, E. I. du Pont de Nemours & Co., Inc.; and treasurer, A. G. Suzie, Armour Research Foundation. Elected to the executive committee for a one-year term were: suppliers—R. O. Hartman, Monsanto Chemical Co., and A. E. Laurence, Phillips Chemical Co.; and manufacturers—J. C. Gallagher, Allis Rubber Co., and L. W. Heide, Acadia. New members of the executive committee for two-year terms are: suppliers—H. E. Anderson, B. F. Goodrich Chemical Co., and R. A. Anscheutz, Witco Chemical Co; and manufacturers—John Groot, Dryden Rubber Division, Sheller Mfg. Co., and V. J. LaBrecque, Victor Mfg. & Gasket Co.

The nominating committee, headed by Mr. Heide, included Francis Frost, Frost Rubber Co.; Edward Meyer, Herron & Meyer; B. W. Hubbard, Ideal Roller & Mfg. Co., and Mr. Anderson.

Silicone Rubber Bonding Agent

A NEW chemical development that makes possible a bond between silicone rubber and metals or ceramics that is said to be stronger than the rubber itself has been announced by the chemical department of General Electric Corp., Pittsfield, Mass. Designated as G-E 81267 primer, a thin, light-colored liquid, the new development permits the bonding of G-E silicone rubber 81223 to almost any surface. Bonds to glass, ceramics, aluminum, steel, tin, and copper are possible, and shear strength measurements of bonds to steel are approximately 700 psi.

Before bonding the silicone rubber to a surface, it is first necessary to remove all grease and dirt from the surface. The G-E 81267 primer is then applied by dipping and draining, spraying, or brushing, and the film is allowed to air dry for 20 minutes. Some surfaces, such as tin, requires a short heat treatment to complete the drying. The coated surface is then rinsed with water and dried. The primed surface can then be molded under pressure against freshened G-E high-strength silicone rubber compound for 10-20 minutes at 125° C., or for 20-25 minutes in 40-psi. steam, and may usually be removed from the mold while hot. The new development makes possible a wide variety of silicone rubber-to-metal molded products, such as shock and engine mounts, and improved rubber-glass laminated structures.

Dinsmore's AIC Talk

R. P. DINSMORE, vice president in charge of research and development, Goodyear Tire & Rubber Co., spoke before the American Institute of Chemists at their meeting in Niagara Falls, Ont., Canada, on "The Human Element in Research Exploitation."

A successful business is usually conducted according to principles and regulations which are definite and generally understood, but every such organization also depends on certain human intangibles which strongly influence the effective cooperation of its personnel, Dr. Dinsmore said. The utilization of any group of people for the achievement of worthy objectives must rely for success on these intangible factors.

Turning to the importance of the human element in the matter of placing new research developments into successful commercial operation, the speaker said there was no intention to belittle the role of such tangible factors as adequate research preparation, adequate piloting, market survey, market testing, patent survey, and adequate organization directed toward synchronized sales service, research, and product development, since these well-tested requirements form the foundation for the entire development.

Stressing the need of a harmonious relation, closely knit liaison and understanding among development, production, and sales departments, Dr. Dinsmore stated that "the importance of cooperation which is both broad and deep cannot be over emphasized. By broad, I mean all the way across the business and including the customer, while by deep I mean from the top of the organization down to the individual workman, technician, or salesman."

After citing several case histories from the experiences of the Goodyear organization to demonstrate the value of the proper appreciation of these human intangibles, the speaker closed with a message addressed especially to technical people.

"We are prone to ascribe to our technical results a completeness and finality to which they are not entitled," he said. "Such results are valueless until they enable the achievement of some useful human purpose. Utilization of the pertinent human factors is as important to the accomplishment of this objective as is the construction of a correct scientific foundation."

McClure at Thiokol Club

THE last meeting of the Thiokol Technical Club before fall was held at laboratories of Thiokol Corp., Trenton, N. J., May 17, with H. B. McClure, vice president of Carbide & Carbon Chemicals Co., as speaker. Dr. McClure discussed "Current Developments in Petrochemicals."

The meeting was preceded by a social hour and buffet dinner held outdoors, and this feature materially contributed to the success of the meeting, which attracted 130 members and guests.

J. W. Crosby, Thiokol president, presided and introduced Dr. McClure. Mr. Crosby explained that the Thiokol Technical Club was formed during the early days of the late war for the purpose of discussing the chemical industry as a whole before there was a section of the American Chemical Society in the Trenton area. Organized as a company group, it grew to include members of other companies in the area and to feature speakers from other technical groups.

Dr. McClure first explained that petrochemicals are defined as those made from natural gas or petroleum and stated that 70% of the aliphatic chemicals produced in the United States in 1950 were petrochemicals. He presented a curve to show the growth of synthetic aliphatic chemical production in the United States from 1925 to 1950, emphasizing that between 1940 and 1945, and between 1945 and 1950, the production in pounds had almost doubled, and that it seemed likely that this trend would continue for the immediate future.

Mention was made of the fact that natural gas was replacing coal as a source of aromatic hydrocarbons with the coal hydrogenation plant being built in Brownsville, Tex. Crude oil sources for the hydrogenation process which contain cyclic aliphatics are the most desirable.

Details of the 1945 to 1950 increase in production of the larger tonnage aliphatics, their estimated usage in textiles, automotive, plastic, and other applications, and the growth of principal commodities involving the use of aliphatic chemicals were also shown.

Dr. McClure briefly described some of the syntheses for such things as ethylene glycol, glycerine, acetone, acetaldehyde, etc., in use at present, including the German "oxo" reaction.

It was pointed out that the fourfold increase in vinyl resin production in the last five years had necessitated a similar increase in plasticizers for use with these resins, both of which were derived from petroleum sources. Many new synthetic fibers were made from petrochemicals also, and the outlook for increased production was also considered good here.

As further evidence of the growth of the synthetic organic chemical field, Dr. McClure said that in 1950 his company had brought 21 new chemicals to the point where they were shipped in tank-car lots and 25 to the point where they could be shipped in drum lots.

Hold International Meeting

THE tenth annual international dinner-meeting was held jointly by the Buffalo Rubber Group and the Ontario Rubber Section, C.I.C., on May 18 at the General Brock Hotel, Niagara Falls, Ont., Canada. Approximately 185 members and guests of both groups heard Ira Williams, J. M. Huber Corp., speak on "Chemical Activity and the Oxidation of Rubber."

Using slides to illustrate his talk, Dr. Williams began with a brief discussion of the structure of the rubber molecule and the behavior of rubber in various solvents, including effect on viscosity and swelling properties of the rubber. The speaker then described some recent studies on the reaction of rubber with sulfur, including the mechanism and rate of the reaction, and comparisons with bromine, chloroacetic acid, and zinc propionate. The degrading action of oxygen on rubber was discussed in detail. It was noted that although the addition of small amounts of oxygen will destroy the tensile properties of rubber, the rubber will retain its rebound characteristics. Some of the types of oxidation encountered are: (1) massive oxidation; (2) surface oxidation of unstrained rubber; and (3) mastication oxidation and sun or ozone checking on strained rubber.

Dry Blending of Vinyls

A TALK on "Dry Blending of Vinyls for Extrusion and Sheeting," by Martin G. Caine, Monsanto Chemical Co., featured the April 24 meeting of the Kitchener Rubber Group of the Wellington-Waterloo Section, C.I.C. Some 50 members and guests attended the meeting, held at Dominion Tire Co., Kitchener, Ont., Canada.

Mr. Caine noted that vinyl compounds were originally handled by conventional rubber processing methods for mixing and extrusion. This practice was followed by machinery modifications in an endeavor to make the machinery suit the material. The development of dry blending and use of modified extrusion machines resulted in the expectation that the dry blending method of extrusion may replace conventional methods in the future for the manufacture of insulated wire and cable.

The speaker discussed various types of blenders in detail, as well as design modifications in extruder barrels, cylinders and worms, and noted that production rates of 375-400 pounds per hour with a 4½-inch bore extruder have been achieved in the wire and cable industry with a resultant superior product. The possibilities of the dry blending technique for vinyl sheeting, belting, hose, and tubing were also discussed by Mr. Caine, who showed samples of products made in the Monsanto laboratories.

Revised Government Synthetic Rubber Specifications

A REVISED edition of "Specifications for Government Synthetic Rubbers," effective March 1, 1951, has been issued by the Office of Rubber Reserve, RFC. Three changes have been made in Section A on Specification Limits, as follows: (1) specifications for GR-S-100 and -101 cold rubbers have been established and included; (2) specifications for bound styrene content have been established on all regular types of GR-S; and (3) a specification for Mooney scorch has been added to all regular types of GR-I. In Section B, Sampling, revisions have been made in the sampling procedures for GR-S, GR-S-Blacks, and GR-I.

Section C, Chemical Test Methods for Solid Polymers, shows two changes: (1) an azeotropic distillation method for determining moisture (volatile matter content) replaces the former mill method; and (2) a method for determining bound styrene content has been included as Section C-6. Three changes have been made in Section D, Physical Test Methods for Solid Polymers, as follows: (1) procedures for determining properties of the vulcanizate have been revised to reduce the variability normally introduced during the mixing operation; (2) the method for determining sample characteristics has been revised to comply with the procedure recently adopted by ASTM; and (3) a method for determining scorch time for GR-S has been included. In Section E, Latex Test Methods, the major change has a method for determining the viscosity of the contained polymers of latices replacing the former procedure which determined Mooney viscosity of the latex film.

NEWS of the MONTH

World Surplus of Rubber in 1951 Predicted; End of Most Controls on United States Industry Asked

As a result of the April, Rome intergovernmental meetings on rubber, a world surplus of at least 360,000 long tons of natural and synthetic rubber has been predicted. Some United States industry leaders believe the surplus will be as high as 500,000 tons. The long overdue action of the British Government in banning exports of natural rubber to Communist China from producing countries under its control lends support to the higher surplus figure. This action has already had the effect of reducing the price of natural rubber on world markets between 20 and 30¢ a pound.

The General Services Administration, because of the lower price and increased availability of natural rubber, has indicated that it may soon relinquish its role as exclusive buyer for this country and will lower the price of the rubber it sells to industry as soon as the lower priced rubber reaches the United States.

The Senate Small Business subcommittee's industry "watchdog" committee has asked the Senators to have the National Production Authority's rubber division authorize new rubber consumption for the next three or four months at a 120,000-ton a month level and eliminate controls on small companies using less than one million pounds a month.

The Office of Rubber Reserve of the Reconstruction Finance Corp. is considering "engineering estimates" for increasing the production of GR-S in existing plants by 100,000 long tons a year.

Meetings of many rubber industry advisory committees to the Office of Price Stabilization were held during May, and it appears that most rubber products price ceilings will be under the "tailored"-type regulation procedure. The final date for establishment of all manufacturers' price ceilings has been advanced by OPS from May 28 to July 2.

The vinyl resin industry has taken the position that its products are fully comparable with synthetic rubbers as materials for national defense and has asked that the government take a more "realistic" attitude on this matter.

The United Rubber Workers of America, CIO, will demand a further wage increase and a full union shop throughout the industry in 1951.

Washington Report

By

ARTHUR J. KRAFT

NPA May M-2 Order and Revision

The National Production Authority on May 1 issued an amended M-2, generally increasing permitted consumption of new rubber in civilian items to 100% of the adjusted base-period rate. Rubber permitted to be consumed in replacement passenger-car tires and tubes and certain other items likewise deemed non-essential was held to the April rate of 90% of the base-period level. The items whose production was held to 90% were placed under Appendix B to M-2, effective May 1.

The May 1 amended M-2 also:

(1) Eliminated the grant of extra rubber to fill DO-87 rated orders (farm equipment tires).

(2) Lifted solid tires from the group of transportation items for which DO-97 (MRO) cannot be honored.

(3) Eliminated the prohibition on importing manufactured items containing more natural rubber than permitted, under Appendix A, domestic manufacturers.

(4) Ended the requirement that importers offer 10% of natural rubber latex imports for sale to GSA. This provision was rendered obsolete by the expiration of all private contracts outstanding when NPA banned private imports on December 29.

(5) Ended the requirement that GSA permission be obtained to import balata and gutta percha.

(6) Imposed a 60-day inventory limit on manufacturers' stocks of natural rubber.

(7) Authorized transfer of GR-S and GR-I synthetic rubbers from a manufacturer to a bona-fide subcontractor, provided the transferror retains title to the rubber.

(8) Provided that applications for special allocations of small quantities of rubber to fill DO-rated orders may be "basketed" into a single application up to an aggregate of 500 pounds of new rubber.

(9) Provided that quarterly allocations of synthetic rubber to each consumer will specify how much can be had as cold rubber and how much as regular GR-S.

(10) Provided that manufacturers making no transportation items other than camelback must use the extra allotments given them through administrative adjustments for the purpose of making camelback.

(11) Spelled out the types of rubber for which manufacturers must file monthly reports on consumption and stocks with NPA. No types were eliminated.

The order was subsequently clarified through an amendment issued on May 21, effective that day, making it clear that NPA intended the 30-day inventory limit on tires in the April order is applicable at each stage of distribution. The amendment stated:

"Each place of business engaged in the distribution of tires and tubes shall be deemed a separate person for the purpose of this section, regardless of its ownership or control, and delivery to it shall be subject to this section regardless of whether such delivery is made on consignment, as an intra-company delivery, or otherwise."

The Natural Rubber Content Import Ban

The decision to lift the long-standing ban against importing products not meeting the natural rubber content specifications provided for domestic rubber products was made over the firm opposition of the NPA's Rubber Industry Advisory Committee.

The Rubber Manufacturers Association, Inc., took the issue to Congress in letters to Chairman Burnet Maybank, of the Senate Banking and Currency Committee, to Chairman Lyndon Johnson, of the Senate Armed Services Preparedness Subcommittee, and to Chairman Guy Gillette, of the Senate Small Business Subcommittee on Rubber. Gillette referred the complaint to the Subcommittee's industry "watchdog" committee, composed chiefly of small rubber company executives.

RMA pointed out that NPA's action was taken against the opposition of its Rubber Industry Advisory Committee as expressed at a meeting with the Rubber Division on April 23. RMA hinted that the decision was made by top echelon officials over the objections of the Rubber Division.

RMA argued that lifting the ban is in conflict with Congressional policy, as expressed in the Rubber Act of 1948, as extended, which authorized restrictions on imports necessary to protect the nation's synthetic rubber industry. It pointed to the prospective dangers to small and large companies alike from competition posed by imported products unrestricted as to natural rubber content while American manufacturers are limited both as to total rubber consumption and the natural rubber content of their products. The industry it was said, was concerned with the possibility that imported natural items might be touted to the public and to distributers as superior in quality to domestic products containing synthetic rubber.

Trade sources, meanwhile, reported that hardly had the ink dried on the May 1 amendment to M-2 than a European manufacturer had his agents canvassing American consumers of rubber thread with offers to supply colors and sizes which domestic manufacturers were prohibited from making under the Appendix A specifications.

An effort at getting NPA to restore the ban appeared in prospect for the Industry Advisory Committee meeting scheduled for late May.

In lifting the ban, NPA gave as its reason that in actual practice it was not requiring strict adherence to Appendix A specifications by domestic manufacturers. Therefore, it reasoned, it should not require compliance by foreign manufacturers to the same specification.

The move to lift the ban, it was generally understood by the industry, was prompted by complaints from the State Department and the Economic Cooperation Administration that it was working to restrict trade from countries unable to find enough synthetic rubber to meet the specifications. NPA, too, was finding that Administration had proved difficult.

The Truck Tire Problem

Manufacturers of truck-trailers, through their trade association, placed a full-page advertisement in several newspapers early in May criticizing the government's rubber

Organization Chart

NATIONAL PRODUCTION AUTHORITY
CHEMICALS, RUBBER & FOREST PRODUCTS BUREAU
RUBBER DIVISION

New General Accounting Office Bldg. 2
Fifth & H Sts., N.W., Washington, D. C.
Telephone: Sterling 5200

Office of the Director
Leland E. Spencer, Director
E. D. Kelly, Deputy Director
Edwin A. Harris, Special Assistant
Justin Feldman, Attorney-Adviser
Everett G. Holt, Assistant to Director on Inter-Agency Liaison
Edward J. Webster, Jr., Chief, Adjustment Staff
Geraldine B. Kidston, Administrative Officer

Material Conservation Branch
Aden R. Miller, Acting Chief
George Allison, Deputy Chief

Tire & Tube Section
Ward Fisher, Chief

Industrial Rubber Goods Section
Leonard R. Ervin, Chief

Footwear, Soles & Heels Section
Robert C. Dabney, Chief

Drugs & Sundries Section
Robert C. Dabney, Chief

Technical Consultants
Harry M. Frecker, Industrial Rubber Goods
Richard E. Harmon, Synthetic Polymers
Arthur Nolan, Natural Rubber Latices

Material Requirement & Production Branch
Aden R. Miller, Chief
F. R. Mathews, Deputy Chief

Tire & Tube Section
Paul C. McPherson, Chief

Camelback & Repair Material Section
E. Daniel Wooldridge, Chief
R. S. Breiner, Asst. Chief

Industrial Rubber Goods Section
R. S. Wharton, Chief
Sydney Lamden, Consultant

Footwear Section
Albert H. Wechsler, Chief

Drugs & Sundries Section
Western Wiles, Chief

Soles & Heels Section
Wm. P. Harty, Chief

Proofed Goods Section
H. M. Dannenbaum, Chief

Wire & Cable Section
Grover W. Brown, Chief
Andrew B. Paddock

D. O. Review & Allocations
Harry D. Stewart
Isabel A. Knapp

Materials Allocations Branch
Carl L. Buehl, Chief
Robert Lees, Consultant, Natural Rubber Latex

GR-S Section
George A. Biddle
George W. Scott

Natural Latex & Butyl Section
Thomas J. Curley

Natural Rubber Section
Herman Slomin

N & S Types Section
George A. Biddle

Material Consumption and Inventories Branch
Herbert M. James, Chief

Rubber Usage Section
W. Earl Wade, Chief

Industry Report & Statistical Processing Section
Saul E. Drimmer, Chief

Machinery & Equipment Branch
Harry D. Brown, Acting Chief

Capacities Section
Lester J. Waldron, Asst. Chief

Priorities Section
John W. Hamilton, Asst. Chief

Amortization Section
S. Earle Overley, Chief

Components Liaison Branch
Harry D. Brown, Chief

Textiles Section

Chemicals Section

Metals Section

Reclaim Section
John M. Ball, Chief

CMP Section
Arthur L. Foulger, Jr., Asst. Chief

Misc. Section

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program with regard to heavy stockpiling of natural rubber at the expense of essential civilian products, such as critically short truck tires. The truck-trailer industry also carried its complaint to various Congressmen.

NPA, on May 4, issued a press release claiming an increase of nearly 10% in the weekly rate of production of truck and bus tires as a result of the April revision of M-2 eliminating the spare tire as original equipment on new passenger cars. It also reported an increase of more than 15,000 units by late April over the March weekly average of 88,955 units in tractor and farm equipment tires.

In the first week that the amendment's full effect was felt, the NPA said, truck and bus tire output rose from the March weekly average of 317,434 units to 353,066 units and has continued at that level since. On May 21 it was reported that the May rate will "approach closely" the record production level of the first quarter of 1947, when an average 373,042 truck and bus tires were produced weekly. The trucking industry estimated in March that it was faced with a shortage amounting to 200,000 tires a month.

NPA reported that first-quarter production of camelback amounted to 28,694 tons, nearly as much as the 33,972 tons produced in the first half of 1950. It estimated that the proportion of first-quarter camelback output used to retread passenger-car tires would be enough to retread about 4,850,000 tires.

Increased allotments of rubber for camelback made in April and May to concerns which manufacture no other transportation products ranged upward of 50% over their base-period use. This is expected to yield even greater production of camelback than recorded in the first quarter.

NPA also reported, that on the basis of figures received from rubber consumers, the diversion of rubber to heavy-duty truck and farm equipment tires resulted in some decrease in the production of passenger-car and motorcycle tires in April. As compared with weekly March production averaging 1,202,674 units, production was at 1,167,534 in the week ended April 7 at 1,196,883 in the following week, and at 1,257,168 in the week ended April 21.

May 21, M-2 Revision

The May 21 revision of M-2, aside from clarifying the inventory restriction, made several other minor changes in the regulation. These changes named the reports which rubber consumers must file with NPA, made it clear that production of original equipment motorcycle and bicycle tires are not subject to the 90% limitation, and specifically exempted fiber floor covering from the 90% limitation.

The agency used the announcement of these revisions as the occasion for assuring consumers that, short of all-out war, they will not face severe shortages of rubber products.

NPA said: "Overall production of essential civilian rubber products has neared an all-time high even while the industry has maintained the defense and defense-supporting programs, and there should be few, if any, real shortages in consumers' rubber goods unless there is an all-out war. Even should that happen, the rubber industry would be in a much better position to meet the demands than at any time in its history."

The Rubber Division scheduled a meeting with its rubber industry advisory committee on May 28. Advance reports were that the NPA would make no major changes in its program for June from the pattern established in May and that most of the meeting would be devoted to sizing up third-quarter prospects looking toward developing the allocation program for that period.

NPA Rubber Division Organization

The present organization of the NPA Rubber Division is shown in the accompanying chart. With regard to the background of some of the personnel, Leland E. Spencer, director, former vice president of the Kelly-Springfield Tire Co., was discussed in our January issue, page 462.

E. Dorrance Kelly, deputy director, was most recently on the staff of ECA and was deputy director of the WPB rubber bureau during the postwar period.

Edwin A. Harris, special assistant, was associated with United States Rubber Co. in the tire and mechanical goods sales in the middle thirties. He was project manager of the Frazier-Simplex International Corp. wihen he joined the NPA.

Justin Feldman, attorney-adviser, was formerly a partner in the law firm of Bradspies & Feldman, New York, N. Y.

Everett G. Holt assistant to director on inter-agency liaison has had a long career in government service in the Department of Commerce where he specialized in rubber industry economics.

Edward J. Webster, Jr., chief, adjustment review staff, had a similar position with the Office of the Rubber Director during the late war and most recently was in charge of foreign sales for International B. F. Goodrich Co.

Aden R. Miller, chief of the Materials Conservation and Materials Requirement and Production branches, was with the sales engineering department of The B. F. Goodrich Co. until 1942. During the late war he served with the various government rubber agencies and most recently has been a consultant to the rubber industry.

Carl L. Buehl, chief, Allocation Branch, was with Goodyear Tire & Rubber Co. until 1942, at which time he was assistant to the vice president and sales manager. He served with the government rubber agencies from 1942 to 1947 and then returned to Goodyear.

Harry D. Brown, chief, Machinery and Equipment and Components Liaison branches, was manager of production planning of Gates Rubber Co.

Herbert M. James, chief, Materials Consumption and Inventories Branch, has been with government rubber agencies during and since World War II. A former assistant comptroller and assistant to the executive vice president of U. S. Rubber, Mr. James also spent ten years with the U. S. Tariff and Security & Exchange commission.

George Allison, deputy chief, Material Conservation Branch, was manager of technical service and technical superintendent, processing division, at Goodrich in Akron. He served with ORD and successor agencies from 1943 to 1946.

Leonard R. Ervin is from the Boston Woven Hose & Rubber Co.; Robert C. Dabney, a consultant; Paul C. McPherson, from Seiberling Rubber Co.; E. Daniel Wooldridge, Oliver Tire & Rubber Co.; Richard S. Wharton, Hewitt-Robins, Inc.; Albert H. Weschler, Converse Rubber Co.; Western Wiles, Faultless Rubber Co.; William P. Harty, Avon Sole Co.; H. M. Dannenbaum, Aldan Rubber Co.; Grover W. Brown, Okonite Co.; Harry D. Stewart, Thomas J. Curley, W. Earle Wade, Saul E. Drimmer, S. Earle Overley, and Arthur L. Foulger, Jr., Commerce Department; George A. Biddle, a consultant; Herman Slomin, from Labor Department; Lester J. Waldron, Waldron Tire Co.; and John M. Ball, Midwest Rubber Reclaiming Co.

Consultants and their respective affiliations are: Harry M. Frecker, U. S. Rubber; Richard E. Harmon, Connecticut Hard Rubber and other small companies; Arthur Nolan, Latex & Rubber, Inc.; Robert Lees, American Anode, Inc.; and Sidney K. Lamden, Dayton Rubber Co.

The Materials Conservation Branch is a technical group, handling technical problems involved in using various types of rubber in rubber products. The Materials Requirement and Production Branch develops requirements of rubber for end-products and balances supply of rubber with production of end-products. The Materials Allocations Branch makes allocations of rubber to individual consumers as provided under M-2.

The Material Consumption and Inventories Branch makes studies, analyses, and reports on consumption and stocks of rubber by industry, also analyzes reports on same submitted by consumers as required by M-2 reporting sections; and prepares forecasts of the international economic outlook and availability of crude rubber.

Machinery and Equipment Branch estimates requirements for plant expansion and replacement of wornout equipment; also, handles requests for certificates of accelerated tax amortization which are acted upon ultimately, after recommendation by NPA, by the Defense Production Administration. Generally this branch is charged with keeping an eye on machinery and equipment needs of the rubber industry.

The Components Liaison Branch develops requirements for components needed in rubber goods manufacture, such as chemicals, textiles, etc. It acts as liaison between manufacturers who come to NPA for aid in getting components and the other divisions of the NPA charged with responsibility for textiles and chemicals.

Curtis NPA Chemical, Rubber Head

The NPA, on May 8, appointed Francis J. Curtis, vice president of Monsanto Chemical Co., to head the Chemical, Rubber and Forest Products Bureau.

NPA said the appointment completes the selection of "assistant administrators" to head four operating bureaus recently set up. The others are metals and minerals, industrial and agricultural equipment, and textiles, leather and specialty equipment.

The so-called Chemicals, Rubber and Forest Products Bureau consists of divisions on chemicals, lumber and lumber products, pulp, paper and paper board, printing and publishing, containers and packaging, and rubber.

GSA on Natural Rubber

Jess Larson, Administrator of General Services, announced on May 18 that the government may drop its role of buying and importing natural rubber for industry "in the foreseeable future."

This prospect, Larson said, is conditioned on whether "the price of rubber continues at more reasonable levels. The exclusive buying program will not be continued one day longer than is absolutely necessary to safeguard this country's rubber supply and to insure distribution and use of the available supply in a manner most advantageous to national defense."

It was also promised that the decline in natural rubber prices would be passed along to industry when the rubber now being purchased at lower prices becomes available in this country for resale. At the time of the statement GSA was able to buy rubber for about 48¢ a pound for a week, a drop of about 30¢. Larson said the agency "has been able to make substantial purchases at the lower price.

"The resale price to industry," he continued, "is based on average buying price plus administrative costs, including shipping and warehousing. We are not in the business of buying rubber to make a profit."

Trade observers generally agreed that GSA will probably drop its selling price for dry natural rubber below the current 66¢ a pound for No. 1 RSS considerably earlier than August, when the lower price material arrives at U. S. ports. A selling price of about 50 to 55¢ in June, with a further reduction in early autumn is considered likely.

As for the government dropping its exclusive buying role in the "foreseeable future"—no one knows when this may happen. Some saw in this promise by Larson an effort to take some of the sting out of his previous utterances concerning critical statements of industry spokesmen directed at the stockpiling and exclusive buying programs. Others saw an effort to dissuade the new RFC Administrator, W. Stuart Symington, from removing GSA's rubber functions, except stockpile buying, to RFC.

The GSA announcement that it will cut its resale price to industry was timed to follow a published confirmation by OPS officials that they have been trying to get GSA to make a sharp cut in its resale price. OPS has asked GSA to use as its selling price the average cost of crude natural rubber accumulated to date for the stockpile and industry. It has been estimated that the average cost ranges between 30 and 35¢ a pound for No. 1 RSS, or about half of GSA's current resale price.

GSA has opposed the OPS request, chiefly on legal grounds. GSA attorneys have contended that the law does not permit them to group the cost of rubber bought for the stockpile and that bought since last December 29, for industry. Congressional authorization and funds are made separately, for stockpiling under the Stockpile Act, and for purchase and resale to industry under the Defense Production Act of 1950. Only the President, or Congress itself, has the authority to disturb the strict bookkeeping segregation of the two types of purchases, according to GSA attorneys.

Whether OPS will persist in endeavoring to get GSA to use its average cost for stockpile rubber in determining its current resale price is not known. Price Stabilizer Michael V. DiSalle told this reporter in mid-May that the dispute had not yet reached his desk, inferentially denying reports that he was about to take it to Defense Mobilizer Charles E. Wilson for decision. DiSalle did confirm, however, that he was aware of the dispute, but that he had not yet considered it timely to carry it further than the current discussions between members of his staff and GSA.

Larson, in his statement, credited the following four factors for bringing the May decline in the natural rubber market:

1. The exclusive buying program by eliminating competitive bidding by government and industry for the same supplies.

2. Refusal of GSA to support the higher price and ability of the agency, in buying all U. S. A. needs, to be selective with regard to both price and markets.

3. British action to plug leaks to Red China.

4. Moves by the government to increase the production of synthetic rubber.

Amid rumors during May that the government was about to free natural rubber latex from import and consumption restrictions, it was ascertained that the DPA had asked GSA and NPA for their reasons why these restrictions should not be lifted.

As far as it could be learned, the latex stockpile goal (5,000 tons in government account and 5,000 in industry stocks) has been met; current imports are high and are expected to remain so; whereas industrial consumption has fallen either owing to seasonal factors or high prices. At its May meeting the Crude Rubber Industry Advisory committee, GSA, agreed on a plan permitting reductions in the agency's resale price but no further details of the plan could be learned.

Further Senate Small Business Testimony

The Senate Small Business subcommittee questioning of RFC witnesses during late April on small company participation

in Rubber Reserve's synthetic rubber operation revealed that Cooper Tire & Rubber Co., participant in the Naugatuck, Conn., plant operated by U. S. Rubber, receives 10% of the fee paid by the government to U. S. Rubber; General Latex Corp., a participant with Goodyear at the Akron plant, 35%; and Pacific Rubber Co., a participant at the Los Angeles plant operated by Minnesota Mining & Mfg. Co., 35%.

Gerald Hadlock, executive director of Rubber Reserve, said the share granted the participant is determined by negotiation between participant and prime contractor; RFC makes no suggestions. RFC has confined its role to requiring prime operators to take in at least one small company participant, giving the operator a choice of small companies.

Hadlock expressed the hope that some of these new participants will develop on the job "know how" so that ultimately they can be assigned in groups as prime operators.

He added that it is not inevitable that the synthetic rubber plants will be bought ultimately by present operators. The operating "know how" is being spread widely.

The Rubber Reserve director answered charges that RFC was responsible for the low state of synthetic rubber production in early 1950 by pinning the responsibility on "international trade agreements and the State Department."

Hadlock disclosed that the new management fees, reflecting a substantial reduction from the fees in last year's contracts, pay about $537,600 for a 60,000-ton operation and about $336,000 for a 30,000-ton operation. The new fee schedule is as follows: 55¢ per 100 pounds for the first 15,000 tons produced; 45¢ per 100 for the next 15,000 tons; 35¢ per 100 for the next 15,000; 25¢ for the next 15,000, and 15¢ per 100 for all production exceeding 60,000 tons by the same operator.

In 1950, Firestone earned in fees $1,201,000; U. S. Rubber, $1,069,900; Goodrich, $884,515; Goodyear, $863,704; Copolymer Corp., $588,886; and General Tire & Rubber Co., $345,387.

Participants and their shares of the fees granted the prime operators, in addition to those already mentioned, follow: Carlisle Corp., 10%, with Firestone at Akron; Mohawk Rubber Co., 10%, also with Goodyear at Akron; McCreary Tire & Rubber Co., 5%, with General Tire at Baytown, and Denman Rubber Co., 10%, with Goodrich at Institute.

Senate Small Business Report

The Senate Small Business subcommittee on rubber scheduled a meeting for May 28 to consider in closed session a report of its "watchdog" industry committee of small rubber goods manufacturers calling for an early end to most government restrictions on the smaller rubber companies.

The report, made by the 21-member industry group appointed by Subcommittee Chairman Gillette to act as liaison between the Senate committee and the NPA, contains 11 specific recommendations and was approved unanimously at a meeting of the industry committee at a meeting on May 21.

The 11 recommendations, on which the "watchdog" committee asks the Senators to press for NPA action, are:

1. NPA should make available at least 120,000 tons of total new rubber for the industry for the next three or four months. The committee called for a "declaration of policy permitting full utilization of the rubber industry's plant capacity—because the greatest asset this country can have in a time of emergency is a large stockpile of immediately usable finished products" rather than raw rubber in government warehouses.

2. Removal of controls over maximum permitted consumption of new rubber "on a systematic basis" beginning shortly after September 1. With synthetic rubber output being increased and the natural rubber stockpile goal "within sight" ample supplies of rubber will be available by fall, it was said.

3. Continue expanding production of synthetics, putting whatever excess that may occur into a government stockpile.

4. Continue present controls requiring high percentage use of synthetics in order to assure their maximum use for an indefinite period.

5. Allocate synthetic rubber on a quarterly basis, rather than monthly. The allocation should be keyed to the specification limiting the percentage content of natural rubber in end items.

6. Increase synthetic rubber allocations to smaller companies and bring government selling prices for imported natural rubber into line with changing world market prices. The committee complained that small companies are allocated little synthetic, but get a large allocation of higher priced natural rubber.

7. Advise rubber consumers of their allotments in sufficient time; so they can properly schedule production.

8. Exempt from restrictions on total rubber usage some 860 companies using less than one million pounds of rubber monthly. This policy should be adopted by September 1, with systematic broadening of the present 25,000-pound a month exemption to 250,000 pounds in June, 500,000 pounds in July, and 750,000 pounds in August. The committee said this plan would leave total usage controls on about 20 companies, who normally account for 75% of the industry's rubber use.

9. Restore the ban on imports of products containing more natural rubber than domestic manufacturers are permitted to use. NPA in lifting the ban on May 1 "has caused and will create unusual hardship on a number of segments of the rubber industry . . . and has disregarded the intent of Congress to protect domestic manufacturers."

10. Eliminate the "unworkable" limitations on tire inventories of manufacturers and distributers which "do not conserve rubber because the controls are not on the consumer."

11. Eliminate the "ill-conceived" standards of essentiality imposed by the May 1 revision of M-2. This restricted production of replacement passenger-car tires and other non-essential items to 90% of last year's rate; while other products were permitted to go above 100%.

RFC Activities

Symington, RFC Administrator since May 1, named Spencer S. Shannon, former director of the materials division of the National Security Resources Board, as his special assistant on May 21, along with the appointment of three other former NSRB officials to key posts in RFC. It is assumed that Shannon's duties will include supervision of the agency's rubber, tin and abaca programs, the job relinquished in April by George C. Oberfell, whose resignation took effect April 30.

Whether RFC will take over some or all of the rubber functions performed by the GSA, as hinted in the President's letter appointing Symington to his new post, remained a mystery in late May.

ORR officials met in Washington on May 17 with representatives of all the operators of its copolymer facilities to review "engineering estimates" looking toward expanding GR-S output approximately 100,000 long tons a year to an annual rate of 860,000 tons.

At this meeting it was decided to hold a further meeting, scheduled for Akron on May 21, this time with representatives of Goodyear, Goodrich, U. S. Rubber, Firestone, General Tire, and Copolymer. Lacking further information, it might be assumed that these six companies might share in bringing the additional tonnages into production.

RFC previously had made clear that the increase being sought at this time would come from existing facilities, by installing new equipment and otherwise striving for maximum output for present facilities. It estimated that it would take about 12 months to attain the full increase.

Third Johnson Report

A third report on rubber preparedness was undergoing preliminary clearance late in May by members of the Senate Armed Services Preparedness subcommittee headed by Lyndon Johnson, with a good chance of the report being released early in June.

Delay in bringing the report to completion was attributed to the fact that the "MacArthur hearings" occupied most of the attention of the committee members during May.

The third report is expected to contain little, if any, new recommendations, but rather confine itself mainly to reviewing the progress made toward following up the subcommittee's previous recommendations. One of these, made in the second report, was that the administration consider greater coordination of the rubber program.

It appeared unlikely that the subcommittee would use this occasion to express any firm conviction on the desirability of reducing the rubber stockpile objective. This subject has been under review for some weeks among various government agencies. The Munitions Board, however, was not expected to arrive at a decision before early June.

OPS Rubber Product Meetings

Rubber manufacturers visited Washington in large numbers during May as members of industry advisory committees appointed by OPS to work out new price ceilings to govern the various segments of the rubber products industry.

Generally, the industry committees were shooting for completion of their tasks by May 28, the effective date of the Manufacturers General Ceiling Price Regulation (CPR 22), issued April 25. As the size of the task of making the necessary statistical calculations became apparent, rubber manufacturers, along with manufacturers in many other fields, urged OPS to postpone the effective date of CPR 22 another month or two. (Postponement until July 2 was announced May 24).

CPR 22 sets ceiling prices for most manufactured products at a pre-Korean base plus actual increases in the costs of materials from June 24, through December 31, 1950 (through March 15, 1951, for imported and agricultural materials) and increases in factory payroll costs through March 15, 1951. Manufacturers with last fiscal year gross sales under $250,000 have the option of remaining under the General Ceiling Price Regulation of January 26, which sets as the ceiling price the highest

price charged during the period December 19, 1950, through January 25, 1951.

The increased material and factory payroll costs can be added to prices in the optional base periods of April 1 through June 24, 1950, or any one of the three previous calendar quarters.

CPR 22 requires that a manufacturer recalculate the ceiling price for each product in his line, using one of four alternate methods provided for articles carried between July 1, 1949, and June 24, 1950. Separate provision is made for repricing articles introduced after the Korean outbreak. The four methods provided for calculating adjustments for changing costs of materials are:

1. The aggregate method—based on a unit of the business or, if the business is not divided into units, on the entire business. If there is more than one plant, the entire business cannot be used.

2. The unit cost method—made separately for each article for which the manufacturer is calculating a ceiling price.

3. The best selling commodity method—the same calculations which must be made under the unit cost method for all items can be made only for the item in the manufacturer's line with the greatest dollar volume. The percentage adjustment for material cost increases calculated for this item can be applied to all other items in the product line.

4. The bill of materials method—much the same as the first method, except that the manufacturer under this method finds the physical bill of materials used in producing goods sold in a short accounting period. Under the aggregate method (#1) the cost of materials must be determined for a full year.

Of the four methods the first is the simplest, but not necessarily the most desirable for all companies. All the methods require painstaking and comprehensive analysis of business data.

In a supplement to CPR 22, OPS permitted manufacturers to calculate the average percentage increase over base-period prices and to compare this percentage with the percentage by which these prices vary from those under the GCPR, whose base period is December 19, 1950, through January 25, 1951.

Rubber Sundries

At a meeting with OPS on May 16 the Rubber Sundries IAC explored at some length the possibility, under a proposed tailored regulation for its industry, of applying industry-wide percentage cost adjustment factors to prices prevailing from December 19, 1950, through January 25, 1951, under the principle set forth in the above supplement to CPR 22.

The committee decided to apply industry-wide cost factors to not less than five items of the entire product line of molded sundries, hand-made sundries, dipped surgical gloves, dipped lined natural rubber gloves, dipped lined neoprene gloves, and bathing caps. It recommended that certain other dipped and molded items be excluded from pricing under the proposed tailored regulation and be priced under CPR 22. The last quarter of 1949 was chosen as the base period for the tailored regulation. All rubber stationers' products except rubber bands were to be left under CPR 22.

Tires and Tubes

The Tire, Tube, and Camelback IAC meeting on May 1 pointed out that calculations of ceilings under CPR 22 would be complicated because of the changing substitutions of materials under the rubber allocation program. At the request of some camelback manufacturers the camelback industry was grouped with other tire repair materials in a separate committee.

On May 8 the Tire and Tube Committee met again with OPS and recommended that industry-wide weighted average percentage cost increase factors be employed in a tailored ceiling price regulation for its industry, covering almost all replacement tires and tubes.

The committee recommended four main product lines and computation of factors on the basis of key items in these lines as follows: conventional passenger-car tires, 6.00x16, 4-ply; low pressure passenger-car tires, 6.70x15, 4-ply; small truck tires, 7.50x20, 8-ply; and large truck tires, 10.00x20, 12-ply. Four corresponding product lines for tubes also were selected.

The committee recommended that the fourth quarter of 1949 be employed as the base period under the CPR 22 formula for all items except truck tires, for which the base period of April 1 to June 24, 1950, was recommended.

Four members of the committee were named to make recommendations on pricing original equipment tires and tubes: H. M. Taylor, Firestone; J. M. Linforth, Goodyear; Walter Baldwin, U. S. Rubber; and G. E. Brunner, Goodrich.

Camelback and Tire Repair Materials

At its meeting with the OPS on May 14 the Camelback and Tire Repair Materials IAC also expressed the desire for a tailored regulation for its industry, with specific dollars-and-cents ceilings on major grades of camelback and repair material. The committee proposed that ceilings for other grades and items be fixed on the basis of customary differentials by employing industry-wide weighted average percentage cost increase factors. Members contended that it would be confusing to the trade if it operated under individual ceilings calculated under CPR 22.

Ceilings were proposed for standard products based on cost studies of the following items: Grades A, C, and F natural and synthetic rubber camelback; cushion gum; cord fabric; and vulcanizing cement. It was proposed that the new ceilings for tube repair kits, airbags, and new tire patches be calculated by applying industry-wide weighted average cost increase factors. Also proposed was that differentials be employed to calculate ceilings on the various grades of camelback based on the proportion of natural or synthetic rubber used in its production. This standard and others would be used to prevent downgrading of camelback with fillers and reclaimed rubber.

The latter suggestion was strongly endorsed by the Tire and Tube Dealers IAC at a meeting with OPS on May 18. The dealers called upon OPS to establish firm specifications for different grades of camelback which would carry markings that would appear on the retreaded tires for the benefit of the public. The committee recommended that dollars-and-cents ceilings be established for carcasses and for retread services with differentials for various grades of materials used. A seven-man subcommittee was named to consider specifications for retreading services, using Army specifications as a starting point.

Mechanical Goods

Members of the Mechanical Rubber Goods IAC at their third meeting with OPS on May 2 made definite selections of key items which they will use in compiling data to calculate weighted average percentage cost increase factors, all looking toward developing a tailored price regulation for mechanical goods.

OPS then began to poll manufacturers for data on the following items to establish their cost trends: Flat belting, nine standard items; hose, 33 items; friction tape, four items; graphic arts, seven items; latex foam, 12; hard rubber, five; matting, three; v-belt, 21, to be reduced later to no more than 10.

Because of the great variety of their products, manufacturers of molded, lathe-cut, and extruded items were unable to come up with a practical formula for computing industry-wide factors for their goods. Manufacturers of rubber adhesives and jar rings also informed OPS that they had decided against industry-wide factors for their segments.

It was decided to include sheet rubber with mechanical goods for the purpose of price regulation, and manufacturers of this item undertook to select key types.

On May 3 the rubber thread subcommittee recommended that industry-wide weighted average percentage cost increase factors be employed in a tailored ceiling price regulation for uncovered rubber thread. The subcommittee recommended that covered rubber thread be left under CPR 22.

On May 4 the subcommittee on chemically blown sponge asked for a tailored price regulation providing for a common industry-wide base period and a common industry-wide adjustment factor within generally grouped product lines.

On May 3 the subcommittee on latex foamed rubber selected seven product lines and key items on which it will be polled by OPS for cost data. Included were head pillows, mattresses, cored slabs, molded shaped cushions, shoulder pads and arm rests, and automotive seat topper pads for original equipment. The choice of a base period will probably be the third quarter of 1949 or the period, April 1 to June 24, 1950.

Soles and Heels

Among the first rubber industry groups to bring in detailed cost information was the Rubber Soles and Heels IAC. This preliminary information, reviewed at a meeting May 17, indicated that ceiling prices in the industry, calculated according to the supplement to CPR 22, would be slightly higher than the prices under the GCPR of January 26.

Committee members said they were willing to have their prices left at the general freeze level under the proposed tailored ceiling price regulation for rubber soles and heels. They asked, however, that consideration be given to any ceiling price advantage thus waived in any subsequent recalculation of ceiling prices.

Much discussion was devoted to the difficulty encountered in determining industry-wide weighted average percentage cost adjustment factors because of the changing compound formulae necessitated by NPA's rubber conservation program. The industry has been obliged to use higher and varying proportions of more expensive natural rubber because of the shortage of cheaper synthetic, and this has complicated the computation of costs.

The committee said the forthcoming tailored regulation should apply only to civilian items because of the special problems attending production for the military. Four members of the committee agreed to submit an outline of the problems of manufacturing for the military and to suggest means of solving them.

The committee selected April 1 to June 24, 1950, as the base period for their calculations and approved the forms on which the industry was asked to submit data to OPS to calculate factors for the tailored regulation.

The key items selected were factory trade, high styrene products, and one each of five lines; repair trade, high styrene products, and all other products.

The data submitted by the industry and reviewed at the May 17 meeting were the following: (1) prices and discounts to all classes of trade during the base period (or net prices if that system is followed); (2) prices and discounts to all classes of trade under GCPR (or net prices); (3) ceiling price to largest class of purchaser on April 1, 1951, for each key item; (4) base-period price to largest class of purchaser per unit for each key item; (5) labor cost adjustment factor computed under CPR 22 for all factory labor; (6) material cost adjustment factor for natural and synthetic rubber computed under CPR 22 for each key item; (7) material cost adjustment factor for other materials computed under CPR 22 for each key item; (8) net sales in dollars for the latest fiscal year ended not later than December 31, 1950, for each product line; (9) average weighted increase in percentage in prices from base period to GCPR ceilings by categories for all products.

In providing these figures the manufacturers made adjustments using the quantities and proportions of rubber materials they were authorized to use during May by NPA allotments, figured at March 15, 1951, prices.

A slight decline in prices of reclaimed rubber was indicated by cost data submitted to OPS by representatives of the industry. This was reported by Rubber Branch officials after meeting with the Reclaimed Rubber IAC on May 3 to discuss a proposed tailored ceiling price regulation which would fix dollars-and-cents ceilings on staple grades of reclaimed rubber. Ceilings on miscellaneous grades are to be fixed on a comparative basis.

Waterproof Rubber Footwear

The Waterproof Rubber Footwear IAC agreed with OPS on April 24 that separate factors will be compiled for two categories of items, waterproof rubber footwear vulcanized as a unit, and rubber-soled footwear with fabric uppers, vulcanized as a unit, but excluding casual footwear, for the preparation of a tailored regulation for rubber footwear.

It was agreed to use the fourth quarter of 1949 as the base period and to employ figures for the entire product line in compiling data for industry-wide weighted cost adjustment factors. All manufacturers were sent forms on which to report much the same data asked of the sole and heel industry. In computing data on material cost increases, the net sales dollar value of production, rather than actual sales, was used because some companies were building inventories and thus their shipments were out of proportion to average shipments.

Coated Fabrics and Unsupported Sheeting

The coated and Combined Fabrics and Unsupported Sheeting IAC asked that any tailored regulation covering its industry be tied in with the forthcoming textile regulation. They asked also that they be permitted to calculate labor adjustment factors on the basis of individual commodities and that textile material factors be kept separate from coated material factors in those calculations.

Other Industry News

Rome Rubber Meetings

The international meetings on rubber, held in Rome, Italy, during April and briefly mentioned last month, consisted of a meeting of representatives of ten governments from producing and consuming nations who resumed discussion of mutual rubber supply problems following their meeting in London in February and the Rubber Study Group Conference which began April 16.

It was as a result of the first meeting that, according to the final press release of April 22, after exploring the possibility of developing some form of intergovernmental action for the equitable distribution of rubber and securing a greater measure of stability, those present decided "there were serious practical difficulties in the way of effective intergovernmental action . . . ." These "difficulties," as reported last month, were the refusal of the United States to sign a long-term, fixed-price agreement on natural rubber or to agree to the international allocation of American synthetic rubber.

The Rubber Study Group Conference in its press release of April 21 estimated that world production of natural rubber in 1951 would be about 1,870,000 long tons; while production of synthetic rubber in member countries would be about 915,000 long tons. World consumption in 1951 was estimated at 1,530,000 long tons of natural rubber and 895,000 long tons of synthetic rubber, apart from the synthetic rubber produced in non-member countries (Russia). The balance over estimated production was expected to be absorbed into governmental and commercial stocks. Tables of the estimates made by the Group are given herewith.

World production of natural rubber latex in 1951 was estimated at 120,000 long tons (dry rubber content); while consumption was considered to reach 105,000 to 110,000 long tons (dry rubber content). These figures are included in the estimates for world production and consumption of natural rubber.

ESTIMATED NATURAL RUBBER PRODUCTION IN 1951

(In 1,000 Long Tons)

Malaya	695
Indonesia	700
Ceylon	110
Vietnam and Cambodia	48
Thailand	110
British Borneo	82
Burma	11
Liberia	33
Belgian Africa	13
British Africa	14
French Africa	2
Other Countries	52
Total	1,870

ESTIMATED NATURAL AND SYNTHETIC RUBBER CONSUMPTION IN 1951

(In 1,000 Long Tons)

	Natural	Synthetic*	Total
U. S. A.	440	830	1,270
United Kingdom	229	4	233
Belgium	15	1	16
Denmark	5	†	5
France	120	12	132
West Germany	84	6	90
Italy	49	7	56
Netherlands	17	1	18
Australia	35	†	35
Canada	44	31	75
Other countries	492	3	495
TOTAL	1,530	895	2,425

* Excluding Russian produced synthetic rubber.

† A small amount of synthetic rubber is expected to be used.

Synthetic rubber production was estimated at 844,000 long tons in the U. S. A., 68,000 long tons in Canada, and 3,000 long tons from West Germany, for a total of 915,000 long tons.

Progress in some aspects of packing rubber were mentioned, and the complaint of certain consuming countries that producers improve the quality of their rubber, and that the remilling organizations seek better methods to improve cleanliness of remilled grades consumed principally in the U. S. A., were recorded.

Development of the supply of "technically classified rubber" was reviewed, and the hope expressed that substantial quantities of this rubber would reach consumers during 1951 so that at the next Study Group meeting further information on this-type rubber could be provided.

Further promotion of the use of rubber in road surfaces, of rubber tires in tropical countries, and of new latex applications were considered desirable long-term projects.

James J. Newman, Goodrich vice president, on his return from the Rome meetings said on May 8 that American consumers can expect lower rubber product prices this year owing to a larger world rubber surplus. He said world rubber supply would be the largest in history—approximately 2,800,000 long tons, including both natural and synthetic rubbers.

Opinions on the amount that will be consumed in 1951 vary, he declared. While the Rubber Study Group estimate was 2,425,000 tons, he said the Goodrich estimate was approximately 2,270,000 tons. In his opinion the Study Group estimate was too liberal and apparently based on very high shipments to the Iron Curtain countries since Korea. The Goodrich consumption estimate of world consumption in 1951 would leave a surplus of more than 500,000 long tons, rather than the 360,000 long tons estimated by the Study Group.

William O'Neil, president, General Tire, another delegate to the Rome meetings, said on his return that he found the world's rubber conditions encouraging.

"The leaders of countries throughout the world are discovering that rubber is a true measure of the standard of living in a country. They see what rubber has done for America's industrial might, its transportation and agricultural facilities, and they are coming to us every day for help with the hope that it will raise living standards in their own countries," O'Neil stated.

Of vital interest to all the nations attending the Rome meetings was the great progress that has been made in the United States synthetic rubber industry, he added. One of the natural rubber producing nations reportedly made an inquiry about the possibility of installing a synthetic rubber plant.

P. W. Litchfield, Goodyear chairman, on his return from the Rome meetings and a tour of Europe said he was convinced that the United States should increase the capacity of its synthetic rubber plants by nearly 50% in the immediate future.

In support of this statement he said the world use of rubber has been going up every decade, at least for the past 40 years, by as much as 100%. United States consumption is running nearly double what it was before the last war, and more and more other nations are increasing their rubber consumption. Then there is the fact that no appreciable amount of rubber trees has been planted in the last decade, largely, of course, because of the war and the highly unsettled conditions in the growing areas in the last few years.

"All this means that any increase in consumption will have to come from greater synthetic production," Litchfield

reasons. "There won't be enough tree rubber."

Harvey S. Firestone, Jr., chairman of the Firestone company, on May 23, following his return from Europe and the Rome meetings said that with greatly increased production and the acquisition of a substantial stockpile, the crisis in rubber is over.

"It is now time to take a realistic view on rubber," he continued. "The laws of supply and demand should prevail, allowing natural rubber and synthetic rubber to find their proper place in world markets without interference from artificial price agreements."

British Bars Rubber to China

Following the action of British Malaya in April of requiring export licenses for rubber going to Communist China and Russia, Great Britain, on May 10, banned any further shipments of rubber to Communist China during 1951. This action was taken after it was revealed in the House of Commons that British Malaya had sold 122,000 tons of rubber to China and Hong Kong and 40,400 tons to Russia since the Korean war began in June, 1950.

Sir Hartley Shawcross, president of the British Board of Trade, announced that in view of China's "abnormally high" imports of rubber during the first quarter of 1951, her civilian needs for the year would be regarded as satisfied, and Britain's rubber producing colonies would be instructed to halt further deliveries. The British Government will buy the rubber for which contracts were signed before the embargo and hoped that other rubber producing countries such as Indonesia would also withhold supplies from China.

A sharp drop in the price of rubber on both London and Singapore markets followed the announcement of this new policy. The plantation industry expressed concern at the failure of the Board of Trade to state at what price the commandeered rubber (about 50,000 tons) would be taken over, and what settlement would be made with buyers acting for Chinese or Russian ultimate consumers who have in most cases already paid cash for the rubber they will not get.

John L. Collyer, president of Goodrich, on May 4 said the announcement of the British Colonial Office that British Malaya has been selling unusually large quantities of rubber to Russia and Communist China since the outbreak of the Korean war is a matter of common knowledge both here and abroad.

"Information regarding the flow of rubber supplies in increasing volume to Russia and China may have come as a shock to Parliament and to the British people, but this situation has been widely known in the United States for many months," Collyer said.[1]

"It would be of interest to all free peoples to know how Malaya is being paid for the rubber moving into China since the Korean war. At an average price of 70c a pound, the 120,000 tons of rubber purchased by China in recent months would cost approximately $188,160,000. In view of the known inflation and the lack of gold in China payment poses an interesting question.

"China's capacity to consume rubber is estimated at not more than 25,000 tons a year. Is the large amount of rubber flowing into China being stockpiled for use against the United Nations' forces in Korea, or is it going to Russia to supply its growing military machine?

"How much additional rubber, above the 120,000 tons, has gone to China from areas like the Republic of Indonesia where figures on exports are not available, or are unreliable?"

After commenting on the action of the Malayan Government on April 6 in requiring export licenses for shipments of rubber to all countries except the United Kingdom, the United States, and Canada, Collyer added that it was regrettable that this action was not taken shortly after the outbreak of the Korean war since it might have helped to reduce the great inflation in rubber prices.

In conclusion Collyer said: "It is the responsibility of the British and Malayan governments and other rubber producing areas to curtail the movement of rubber to unfriendly powers by wise administration of export license programs."

Vinyl Resin Shortage

John R. Hoover, vice president-sales, B. F. Goodrich Chemical Co., said in Cleveland in mid-May that the current abnormal demand for vinyl resins, a result of emergency conditions, would place strain on the productive resources of the industry if the resin plants could be operated at full capacity. However, when a serious basic chemical shortage is superimposed on this demand, the problem assumes critical proportions, particularly for the hundreds of companies engaged in processing and fabricating these versatile resins.

Despite a temporary "softening" in the consumer goods markets, affecting vinyl film and sheeting sales, market requirements for the resins still exceed supply by a wide margin. If the seasonal peak in film and sheeting occurs in the fall as anticipated, the situation will be still further aggravated. Government need of resins is steadily increasing, particularly in wire, cable and coated fabrics, and the possibility of government allocation of the basic chemicals still exists.

The vinyl industry, if it is to satisfy the requirements of three groups—military, industry, and consumer—must grow. Existing industry capacity would be hard pressed to supply the military and other essential needs of full-scale war.

Plans for expansion have been made, and some are well under way. Certain hazards are present, however, which can seriously retard this necessary growth.

Construction of plant facilities today costs several times more than did comparable expansions during the period 1940 to 1945. Further, with the rapid pace of vinyl resin technology, it is likely that these facilities will be largely obsolete in five years.

This huge capital investment coupled with the attendant risk of near future obsolescence has prompted industry to apply for Certificates of Necessity from the government to permit more rapid amortization.

It is most important that the accelerated amortization feature of the Defense Production Act regarding new chemical facilities be viewed in its broadest sense. Adoption of a "tough" attitude by government could prove the greatest kind of deterrent to private industry making needed additions to our productive capacity.

Danger of price rollbacks is another retarding factor, especially for the basic chemical producers (chlorine, acetylene, sulfuric acid, etc.)—the suppliers of the vital feed stocks that make manufacture of vinyl resins possible. Expansion of these basic raw materials requires a tremendous capital outlay with great risk that the returns will not prove adequate.

It is necessary that private industry be encouraged by government to provide the additional plant facilities needed. In a normal period industry can evaluate its market potential and predetermine to a great extent the risk involved in expansion. But in this period of mobilization and superboom the market pulse cannot be accurately felt; consequently there is hesitation in making gigantic capital outlays for new facilities without commensurate incentives.

If the government does not soon take a more realistic attitude on these matters, there are sure to be delays of a very costly nature to our economy and our national security.

Vinyl resins are key materials for national defense, fully comparable in their essentiality to the synthetic rubbers. The vinyl industry can only be geared for action if it continues to build for strength, keeping its technical teams active, its plants operating, improving, and expanding, and its skilled labor force busy. Mr. Hoover concluded.

Labor News

The URWA policy committee meeting in Detroit in early May drafted a nine-point program of demands to be made on the rubber industry. The union asserted that the mobilization program had caused prices to spiral so rapidly that the wage increases won in 1950 have been wiped out while corporate profits have been permitted to attain unparalleled peaks.

The union's program calls for: (1) a substantial wage increase; (2) extension and improvement of pension, insurance, surgical, medical, and hospitalization programs; (3) continuation of efforts to obtain full union shop contracts; (4) correction of intra-plant, interplant, and area inequalities and inequities; (5) improvement of night-shift bonuses, holiday pay, and vacation programs and other fringe benefits; (6) a meeting of the Canadian section of the international policy committee to formulate an economic program in Canada. (7) prevention of speedups; (8) contract provisions providing for the right to reopen wage negotiations at any time upon 30 days or less notice; (9) improved benefits for employes entering the Armed Services.

In a joint release on May 18, General Tire and URWA locals 9 and 312 issued a statement that a master labor contract was signed May 17 at Cleveland by the rubber company and the United Rubber Workers, CIO, covering employes as the bargaining units at the Waco, Tex., and Akron, O., plants.

Completing negotiations which began April 4, the new contract provides for a union shop. In granting the union shop, the company did so provided the National Labor Relations Board certifies the authority to the company for such union security through an election conducted by the government agency among the employes in the bargaining units, the statement said.

The new contract will run until March 1, 1953. Both the company and the union have the right to reopen the general wage scale for negotiation following 30 days notice.

Under the terms of the union shop agreement all employes now in the bargaining units must join the union within 30 days after the effective date of the agreement, and all newly hired employes covered by the bargaining units must become members of the union as conditions of employment.

Approval by majority of members of the

[1] India Rubber World, Sept., 1950, p. 694.

two local unions, and the general executive board of the international union is required before the new contract becomes official.

Wage negotiations between the URWA and U. S. Rubber will begin in New York on June 7. Also included in these negotiations will be the demand for a full union shop.

On or about May 1, the five-month-old strike of the URWA local at the West Haven, Conn., plant of Armstrong Rubber Co. was finally setteled. Several days previous to that date the company had announced that it was opening the plant and that workers who did not return to their jobs would be likely to lose their seniority rights. New negotiations between the union and the company began at once, and after about 48 hours a new contract, including a wage increase, was signed, and the several hundred workers returned to their jobs.

EAST

Glen Wilson Promoted

Glen E. Wilson has been named director of employe relations, a newly created post of B. F. Goodrich Chemical Co., 324 Rose Bldg., Cleveland 15, O., according to President W. S. Richardson. Wilson will report to Richardson and have charge of employe relations in all plants the company operates throughout the country. With The B. F. Goodrich Co., Akron, parent firm of the chemical company, since 1928, Wilson started as an accountant 23 years ago. He had a wide variety of responsibilities at Plant 4 until 1942, when he was named personnel manager of the American rubber plant operated by Goodrich Chemical for the government in Louisville, Ky. Returning to Akron in 1946, he became a representative of the company's employe relations department.

Goodrich Chemical Developments

Use of a protective interior coating of Geon polyvinyl chloride latex, a product of Goodrich Chemical, insures resistance to chemicals, greases, and moisture vapor transmission in fiber drums made by Virginia Barrel Co., Chester, Pa. The coating protects both the drum and the product being shipped, and drums coated with the latex have been used for shipping lubricating greases, ion-exchange resins, textile sizings, and other materials. An external coating of the latex provides excellent abrasion resistance, protection against water or moisture penetration, and an attractive, washable finish.

Hycar nitrile rubber, a product of Goodrich Chemical, is used by Parker, Stearns & Co., Brooklyn, N. Y., to manufacture a critical rubber seal encircling the cockpit of the F-84 Thunderjet. This seal, a square cross-section, inflatable tube of special shape, is fitted into a U-shaped fuselage channel over which the cockpit canopy slides, and seals the cockpit from any air loss during flight. In manufacture, the rubber is first extruded in the desired profile and joined endlessly by use of a special Hycar cement. The preformed seal with attached inlet tube, which is later connected to the jet plane's compressor pumps, is then placed in a specially designed mold and vulcanized.

RMA Elections

Thomas Robins, Jr., president of Hewitt-Robins, Inc., Buffalo, N. Y., was elected to the board of directors of the Rubber Manufacturers Association, Inc., New York, N. Y., at the annual meeting of that organization in New York on May 8.

Four directors were reelected for three-year terms: C. D. Garretson, president, Electric Hose & Rubber Co., Wilmington, Del.; H. E. Smith, vice president, Raybestos-Manhattan, Inc., Passaic, N. J.; J. P. Seiberling, president, Seiberling Rubbber Co., Barberton, O.; and H. S. Marlor, vice president, United States Rubber Co., New York.

A. L. Viles, president, W. J. Sears, vice president, R. R. Ormsby, vice president and general counsel, C. W. Halligan, treasurer, and R. H. Goebel, secretary, and the other officers of the Association were reelected.

The new director, Mr. Robins, succeeds the late J. Newton Smith, president of Boston Woven Hose & Rubber Co., Cambridge, Mass. Mr. Robins is a member of the Rubber Industry Advisory Committee to the Munitions Board and the United States Department of Commerce and serves as and adviser to the U. S. delegate to the International Rubber Study Group, which completed its eighth meeting in Rome. He is also president of the newly reactivated Kentucky Synthetic Rubber Corp., Louisville, Ky.

Win Honors

United Engineering & Foundry Co., Pittsburgh Pa., has received from the Economic Cooperation Administration a Certificate of Cooperation for furnishing technical assistance to the peoples of the Marshall Plan countries to aid them in maintaining individual liberty, free institutions, and peace. Through the sponsorship of ECA, United has furnished the machinery as well as technical assistance for the majority of the postwar steel mill installations in various countries in Europe as well as in England.

Charles M. Muchnic, a director of United Engineering, engaged in its foreign business for many years, once again has been recognized for his able service and executive ability. On March 8, Henri Bonnet, Ambassador of France to the United States, informed Mr. Muchnic that by Decree of the President of the French Republic, dated January 27, 1951, he had been awarded the decoration of the French Legion of Honor with the rank of Chevalier as a token of gratitude for the services Mr. Muchnic rendered to the economic reconstruction of France. Subsequent to World War I, Mr. Muchnic was awarded a special silver medal by General Petain for his effective services to the Republic of France, not only during the war, but during the reconstruction period which followed. He had previously received similar recognition from the Government of Italy, and the honor of the Order of the Rising Sun from the Japanese Government for similar international services.

Morningstar, Nicol, Inc., 630 W. 51st St. New York 19, N. Y., manufacturer of starches, dextrines, and adhesives, this year is celebrating the one hundredth anniversary of the founding of the firm.

Holds Open House

Sun Rubber Co., Barberton, O., was cited for "outstanding effort and achievement" as a group winner in the Barberton Safety Campaign for 1950. A special safety award was recently presented to Sun in recognition of this accomplishment. All major industrial firms in the community participated in the safety campaign sponsored jointly by the Barberton Safety Council and the Division of Safety & Hygiene of the Industrial Commission of Ohio.

Sun Rubber recently staged an "open house" for the benefit of Barberton's teachers and educators as part of the second annual Business-Industry-Education Day program in the town. Educators were given the opportunity to see their social and scientific theories in action and to see how they contribute to the business system. Sun's contribution included a welcoming address by President Thomas W. Smith, Jr., and discussions on product development by B. A. McDermott, director of art and design; product ingredients, by R. T. Cartlidge, chief chemist; production operations, by G. H. McKiernan, production superintendent; organization and manpower, by Phil Stewart, personnel director; finances, by W. S. Raymer, Jr., assistant secretary-treasurer; and materials, by W. R. Lantz, vice president—purchasing. In addition the company provided organized plant tours and luncheon for the guests.

For Better Factory Control

A. Blair Sutton has been appointed supervisor of weight control at Sun, a new position created to improve control of the company's manufacturing operations. Working under J. E. Hanna, Sun's production control manager, Sutton has the job of determining the exact weight of the various stocks processed preparatory to curing in the pressroom. He accounts for the amount of stock in use each day and sees that all stock comes within requirements listed in production specifications.

Sutton comes to Sun after 35 years in production and scheduling work with The B. F. Goodrich Co. Immediately prior to joining Sun, he was unit head in the Goodrich scheduling department. Before going with Goodrich, he was associated with the Westinghouse Air Brake Corp., Wilmerding, Pa.

Thermoid Advances Cox

Lester F. Cox was elected senior vice president of the Thermoid Co., Trenton, N. J., at a board meeting May 18. He will be in charge of all company plants and manufacturing operations. Thermoid manufactures automotive and industrial rubber, friction, and textile products and operates plants at Trenton; Huntington, Ind.; Nephi, Utah; Charlotte, N. C.; Downey, Calif.; and Welland, Ont., Canada.

Mr. Cox previously had served the company as vice president in charge of rubber manufacturing. He joined Thermoid in 1930 as a production planner and subsequently served as production manager, assistant factory manager, and factory manager. Prior to coming to Thermoid, he had been employed by Murray Rubber, Trenton.

HI-STATE-R

Note

To help supply the current heavy demand our production facilities have recently been doubled

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500 TONS OF SMOKE A DAY

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MPC (Medium Processing Channel)

STANDARD MICRONEX

◆

EPC (Easy Processing Channel)

MICRONEX W-6

◆

HAF (High Abrasion Furnace)

STATEX-R

◆

FF (Fine Furnace)

STATEX-B

◆

FEF (Fast Extruding Furnace)

STATEX-M

◆

HMF (High Modulus Furnace)

STATEX-93

◆

SRF (Semi-Reinforcing Furnace)

FURNEX

◆

COLUMBIAN CARBON CO.
MANUFACTURER

BINNEY & SMITH CO.
DISTRIBUTOR

Buys Alkali Corp. Stock

The executive committee of Pittsburgh Plate Glass Co., Pittsburgh, Pa., recently authorized the purchase of the 49% stock interest in Southern Alkali Corp. held by American Cyanamid Co., New York, N. Y., at a reported purchase price of about $19,000,000. Pittsburgh Plate previously owned 51% of the stock in the alkali company.

Southern Alkali, with chlorine and alkali producing plants at Corpus Christi, Tex., and Lake Charles, La., has been operated by Pittsburgh Plate since the former's incorporation in 1931.

American Cyanamid still retains its 49% interest in Southern Minerals Corp., which is engaged in the production of petroleum in Texas. Pittsburgh Plate also holds 51% interest in the latter concern.

Later E. T. Asplundh was named president of Southern Alkali. Associated with Pittsburgh Plate chemical operations since 1919, Mr. Asplundh has served as vice president in charge of Pittsburgh's Columbia Chemical Division since 1940 and as vice president of Southern Alkali since 1944.

Clarence M. Brown, board chairman of Pittsburgh Plate since 1931 and a member of Southern Alkali's directorate since the firm's incorporation, has been named chairman of its board, a newly created position.

Also continuing as directors of Southern Alkali are Harry B. Higgins, Harold F. Pitcairn, Raymond Pitcairn, and Dwight Means. Mr. Higgins will serve as chairman of the executive committee, and Mr Means as a vice president.

New directors and officers are Leland Hazard, vice president and general counsel, and W. I. Galliher, vice president. Additional directors are Richard B. Tucker and E. D. Griffin.

Adds to Color Facilities

Mid-American Plastics, Inc., Cleveland, O., has announced the addition of manufacturing facilities for dry colorants to be used in the coloring of crystal polystyrene and other thermoplastics. The company has purchased the rights and formulae of the dry color division of Jamison Plastics Corp., New York, N. Y., and the dry coloring operation will be henceforth under the jurisdiction of Mid-America's color division. An entire floor of the company's building, to be devoted to the manufacture of dry colorants, has been completely remodeled and modernized to incorporate the finest facilities. A fully equipped laboratory is operated to assure the maintenance of highest standards in compounding and formulating the colorants.

Mid-America's dry colorants, sold under the trade name, Colorblende, are available in 17 colors matching the Bureau of Standard's colors. Many modifications and variations of these colors can also be supplied upon request. Colorblende is packaged in packets containing the exact amount required to color 100 pounds of crystal polystyrene. To assure uniform coloring of the crystal, the company recommends the use of its dispersing agent, Dispersa, a liquid sold in containers holding the exact amount needed in coloring 100 pounds of polystyrene crystal. The color division of Mid-America is associated with Moslo Enterprises and the Moslo Machinery Co., manufacturer of injection molding machines.

Changes at Firestone

William D. Gohr, purchasing agent for The Firestone Tire & Rubber Co., Akron, O., has been named general manager of the company's Plant 3, which is manufacturing tank cannon, 75-mm. and 57-mm. recoilless rifles, Airpak jet engine containers, and other defense products for the government.

In making the announcement, J. E. Trainer, vice president in charge of production, said that Mr. Gohr's experience during World War II makes him well qualified for his new assignment. In 1941 he was placed in charge of subcontracting and purchasing for the Firestone plant producing 40-mm. anti-aircraft Bofors gun carriages and in 1942 was made general manager of the Bofors plant.

Mr. Gohr joined Firestone in its first college training class in 1924. After sales training with Firestone dealers and stores, he went to the company's textile plant at New Bedford, Mass. In 1930 he returned to Akron and became a purchasing agent for chemicals, where he remained until 1941, when he went to the gun division. In 1943 he returned to the purchasing department as purchasing agent for the company.

A. D. Miller, since 1947 general manager of Firestone's synthetic rubber division, has been named to the staff of J. N. Street, director of chemical laboratories, where he will carry on special development work.

Succeeding him in the synthetic rubber division is C. A. Hill, since 1945 manager of the Firestone operated Rubber Reserve plant at Lake Charles, La.

Mr. Miller started with Firestone as a chemist in the general laboratory 17 years ago while still attending college. Then in 1941 he was named head of the technical division of the Firestone operated Rubber Reserve plant in Akron. Two years later he was made technical manager for all Firestone operated synthetic rubber plants and in 1947 was appointed general manager of the company's synthetic rubber division.

Before coming to Firestone in 1942, Mr. Hill was with Sinclair Oil Co., where he became familiar with the production of butadiene. His first assignment with Firestone was in connection with the construction of the synthetic rubber plant at Baton Rouge, La. Later he went to the management staff at the Port Neches, Texas, synthetic rubber plant, also operated by Firestone.

A. L. Weyand, manager of Akron Plant 2, retired April 30 after 40 years with Firestone. More than 300 of his Firestone colleagues honored him with a banquet and gifts. Mr. Weyand came to Akron in 1911 to become a day worker on treads at Firestone. He soon became a supervisor, then foreman, night superintendent, department manager, and finally production superintendent at Plant 1. In 1939 he went to Plant 2 as plant manager. During 1929 and 1930 he was assigned temporarily as plant manager of the Firestone plant at Brentford, England.

Heyden Chemical Corp., 393 Seventh Ave., New York 1, N. Y., is constructing a new plant at its Fords, N. J., division for the production of para-chloro-benzaldehyde. This plant is part of a general expansion program scheduled by Heyden for 1951.

Ace Changes Sales Set-up

F. C. Snyder, president of Ace Rubber Products, Inc., Akron, O., has announced complete reorganization of the sales structure of his company. Prior to April 21 all Ace Rubber products were sold through the "manufacturer's representaterials known as viscoelastic, since they Ace is now selling through its own organization of field salesmen.

Coincident with the change, Mr. Snyder appointed William J. Worrell sales manager. He previously had been with American Hard Rubber Co., formerly as Midwest representative and lately handling "special sales."

Ace manufactures a large variety of automotive floor and running board mats, both original and replacement. It also produces rubber stair treads, door and floor mats for home and commercial use.

Decision to establish its own sales organization was made by Ace management, says Mr. Snyder, with the conclusion that current conditions make it necessary to maintain close contact with the customers. In view of rubber restrictions and business controls, he believes that direct contact will result in better and faster service Expansion of lines will be facilitated by having company salesmen introduce new products. They will also introduce new merchandising and selling aids for the dealers.

Field salesmen already assigned by Ace Rubber and the cities from which they will operate follow: H. Leonard Adler and Al Dubin, Philadelphia, Pa.; O. A. Boldt, Minneapolis, Minn.; E. R. Church, Jackson, Mich.; Arthur Crane, Chicago, Ill.; Kennon Fisk, Denver, Colo.; R. Hoffman, New York, N. Y.; I. J. Phillips, Atlanta, Ga.; J. M. Phillips, Gaffney, S. C.; Lou Wallins, New Orleans, La.; Phillip Meyers, Toledo, O.; J. C. Wade, Ft. Worth, Tex.; Collins Carlisle, Kansas City, Mo.; and Sol Sechooner, Los Angeles, Calif.

Veteran Workers Honored

Seventy-three employes of Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N. J., who completed 25 years with the company during the past year were honored recently at the seventh annual dinner of the Manhattan Pioneers attended by more than 600 active and retired veterans with wives. The new class, the largest since Manhattan Pioneers was organized in 1945, joined a group of more than 436 active employes with services running from 25 to 57 years. The new Pioneers were presented with gold lapel buttons, and members entering new five-year groups received additional diamond studs.

John F. D. Rohrbach, president of Raybestos-Manhattan, was the principal speaker. Other speakers were John H. Matthews, and Harry E. Smith, vice presidents, and Dennis J. Fenelon, director of labor relations.

Charles Kuhn, oldest active employe of Manhattan Rubber Division, with 57 years' service as a sales executive in the company's New York sales office, retired April 30. He had started as an office boy in March, 1894. In addition to his long and successful career as a sales executive in metropolitan New York, Mr. Kuhn is also well known nationally for rubber specialties he developed and for which he established markets.

Dewey & Almy Developments

Dewey & Almy Chemical Co., 62 Whittemore Ave., Cambridge 40, Mass., has announced that a method based on its Cryovac process has been developed for centrally prepackaging fresh, cut-up chickens in trays for retail sale and is now being used by a number of large packers. The method utilizes the company's Cry-O-Rap film, and the process makes possible elimination of weight loss and better retention of quality. In the prepacking operation the chickens are cleaned, dressed, cut up, and packed according to weight in waxed cardboard trays placed in the moisture-proof Cry-O-Rap plastic bags. Air is exhausted from the bags, which are then vacuum sealed. In the last step, the filled bags are momentarily immersed into hot water which shrinks the bag tightly around the tray and gives a smooth wrap with high product visibility. Shipped in shaved ice from processing center to retailer, this package is said to give longer shelf life and insure freshness, flavor, and packaged weight at point of sale.

Dewey & Almy has instituted, under contract with the Army Signal Corps, a two-year research program on the development of the first free-flight meteorological sounding balloon capable of rising to 150,000 feet, or 30 miles. The present record of 136,000 feet, or about 26 miles, was set with a Dewey & Almy balloon on October 4, 1950. The contract specifications call for a balloon able to lift to the 30-mile altitude a five-pound load of instruments for studying cosmic rays and atmospheric conditions. Sounding balloons are used to carry aloft instruments to record or transmit data on upper air conditions and are used for weather studies. Dewey & Almy sounding balloons are made by the rubber dipping process, with molds being dipped into tanks containing latex emulsions.

Seiberling Directors Elect

Directors of Seiberling Rubber Co., Akron, O., met recently and reelected all company officers except J. L. Cochrun, retired executive vice president. No executive vice president was named. Officers are: J. P. Seiberling, president and chairman of the board; H. P. Schrank, vice president, production; L. M. Seiberling, vice president, sales; R. J. Thomas, vice president-treasurer; C. E. Jones, vice president-comptroller; W. P. Seiberling, secretary; H. E. Thomas, assistant secretary-treasurer; J. W. Dessecker, assistant secretary; W. H. Oburn, assistant treasurer.

A. Bamberger Corp., 703 Bedford Ave., Brooklyn 6, N. Y., has announced the installation of new equipment to reduce to small particle size plastics or resinous material or scrap in any size of blocks or lumps. Polyethylene and vinyl plastic lumps the size of a drum and weighing several hundred pounds have been granulated successfully into molding powder and subsequently pelletized for reuse. The new equipment can handle any type of rigid or soft material in any size and is being made available for the company's custom reprocessing service to help in extending supplies of critical plastics by making them available for reuse.

Charles Mayer Studios

Frederick W. Dover

Heads Plastics Operations

A. Schulman, Inc., Akron, O., has appointed Frederick W. Dover manager of plastics operations. Dover, with 12 years' experience in the plastics industry, will be in charge of buying, selling, and processing virgin plastics and reground molding compounds for the company.

Before joining Schulman he had been engaged in research, production, and sales of plastic materials.

Quaker Rubber Corp., division of H. K. Porter Co., Inc., Philadelphia 42, Pa., has developed a "Conservation Maintenance Plan" to aid industry in conserving rubber and increasing production with present equipment. Included in the program are a handbook, wall charts, and monthly bulletins, all containing hundreds of illustrations and suggestions on how to select, install, and maintain conveyer belting, flat transmission belting, V-belts, hose, and packing. In announcing the plan, J. R. Keach, Quaker vice president and general manager, said:

"Within the next few months we expect this rubber-saving plan to be enthusiastically endorsed by leading industrial plants from coast to coast."

Available to all industrial plants, the program is expected to prolong the life of industrial rubber products and thereby save the costs of repair and replacement of parts, with consequent conservation of vital rubber.

Allegheny Plastics, Inc., Sewickley, Pa., is producing eight-inch "timing disks" made of plastic instead of thin aluminum for use in certain types of time-cycle control instruments. The plastic disk is not only a readily available substitute material, but, according to the company, is an actual improvement over the aluminum type. The plastic disk will not crimp during handling, may be perforated on the timing track without leaving a burr possibly to catch as the disk revolves through its timing cycle, and is believed to be less expensive to the consumer. The new disk is available with various types of imprinted graduations, and samples can be obtained upon request

Dedicates New Unit

E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del., dedicated the new $30,000,000 addition to its experimental station on May 10 before an assembly of some 200 distinguished scientists. In a morning session, held at the Playhouse Theatre, the guests were welcomed by E. K. Bolton, director of the company's chemical department; G. M. Read, head of the engineering department, spoke on design and construction highlights of the addition; and there was a showing of a new color film, "A Story of du Pont Research." According to Mr. Read, the addition consists of 19 buildings, nine of which are laboratory buildings. Most of these new structures stand in a landscaped area of 57 areas overlooking the older section of the station. In addition to the new buildings, two of the older laboratory buildings were substantially enlarged, and a former clubhouse converted into an employes' cafeteria. The total new floor area is 630,000 square feet, and the station now employs some 800 technical trained research workers and approximately 1,500 non-technical employes.

During the afternoon the guests were taken on an inspection tour of the new laboratories and also shown a series of exhibits illustrating the types of research work being done and some of the recent accomplishments. The program concluded with an evening banquet at the Hotel Du Pont, with speeches by James B. Conant, president of Harvard University, and Crawford H. Greenwalt, president of du Pont.

Mansfield Tire Elections

An expansion of executive personnel in line with the broadening operations of The Mansfield Tire & Rubber Co., Mansfield, O., was announced last month following a directors' meeting at which the following officers were reelected: G. W. Stephens, chairman of the board; H. B. Soulen, president; and J. S. Wainwright, vice president.

In the expansion of the executive staff James H. Hoffman becomes executive vice president of the company, and E. E. Stevens, vice president in charge of sales. Hoffman was secretary-treasurer, and Stevens, general sales manager.

In other changes, E. P. Stephens was elected secretary of the company, and Boyd Weaver, treasurer. The former was assistant secretary, and Weaver, controller.

Lukens Chemical Co., 227 California St., Newton 58, Mass., recently was formed to sell quality pigments to the rubber, plastics, paint, and paper industries in New England. The company has research and testing facilities in its own laboratories. The latter will enable Lukens Chemical competently to recommend, supply, and service pigments to its customers. At present "Laminar," the processing-high loading extender pigment, is Lukens Chemicals' sole account. As new pigments are approved by Lukens laboratories, they will be presented to New England industry. Alan R. Lukens, with more than 30 years' technical experience in engineering pigments for the rubber, paint, paper, and flooring industries, and Donald N. Lukens are the officers of Lukens Chemical Co.

Transfers Facilities

General Electric Co., chemical department, Pittsfield, Mass., has transferred facilities for molding and extruding G-E silicone rubber parts from Pittsfield to the Decatur, Ill. plant. At the same time, new equipment has been added that will enable production to be tripled. Centralizing of the firm's silicone rubber fabricating operations will permit better service to the aircraft, automotive, and electrical industries. New extruders and molding presses will also facilitate the manufacture of larger-size parts than have been formerly available from the company.

Changes in Personnel

Leroy S. Moody, of the chemical department, was appointed product evaluation supervisor of the department's new product development laboratory. Dr. Moody worked for a year following his graduation at the Massachusetts Institute of Technology as a research chemist on the Manhattan Project. He joined G-E in 1945 as a chemist.

James Wilson has been named supervisor of the chemical department's Taunton, Mass., plant production section. He started with the company in 1941 at the Fort Wayne, Ind., plant and was most recently assistant supervisor of the power transformer division of the Pittsfield apparatus works.

E. E. Hinson, also of the chemical department, has been assigned as sales representative in Washington, D. C., with headquarters at 806 15th St. N. W. He will have responsibility for the sale of industrial laminated plastics and electric insulating materials including varnishes, tapes, and mica. Mr. Hinson came to the company in 1947 after his war service. In 1948 he was assigned to the Pittsburgh, Pa., office as sales specialist on roll-neck bearings. Prior to his recent appointment he was a sales representative in Cleveland O.

G. Arthur Gustafson has been appointed manufacturing and materials engineer of the plastics division, succeeding R. D. Knies, transferred to the aircraft gas turbine division at Lockland, O. As a temporary assignment, Mr. Gustafson will also be in charge of mold manufacture. He started with G-E in 1929 as superintendent of the Meriden, Conn., molding plant; in 1932 was placed in charge of plastics engineering at Pittsfield; in 1936 returned to Meriden as manager of the plant there; and in 1941 assumed the added responsibility of manager of the Taunton, Mass., molding plant. The following year Mr. Gustafson returned to Pittsfield as manufacturing manager of the plastics division and in 1945 became manager of the chemical department's construction division. Three years later he was named manager of the Pittsfield molded products plant and in 1950, manufacturing engineer of the chemical department's manufacturing division.

Dial, Curme Advanced

Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y., recently announced several executive changes.

Morse G. Dial has been elected executive vice president. Mr. Dial joined the corporation in 1929 as a member of the sales staff of Carbide & Carbon Chemicals Corp. and was successively sales manager and general manager of its Pyrofax division. In 1937 he became assistant secretary and treasurer of Union Carbide and in 1945 secretary-treasurer. Since 1949 he has been a director, vice president, and treasurer of Union Carbide.

George O. Curme, Jr., has been elected vice president in charge of research of Union Carbide and now heads all research activities of Union Carbide. Since 1948 he has been vice president in charge of chemical research for the corporation and for many years a vice president of Bakelite Co. and Carbide & Carbon Chemicals Co., both divisions of Union Carbide.

Dr. Curme, a pioneer in research, is said to be the first to develop the chemistry of aliphatic compounds—sometimes referred to as petro-chemicals—in the United States. His research work on acetylene at the Mellon Institute of Industrial Research, resulted in the formation of Carbide & Carbon Chemicals Corp. Dr. Curme has also been the recipient of many medals in recognition of his achievements in chemistry, including the Chandler Medal from Columbia University in 1933; the Perkin Medal of the Society of the Chemical Industry in 1935; the Elliott Cresson Medal from Franklin Institute in 1936; the National Modern Pioneer Award from the National Association of Manufacturers in 1940; the Willard Gibbs Medal from the American Chemical Society in 1944; and a Fellowship in the New York Academy of Science in 1950.

Fred H. Haggerson, president of Union Carbide, has also been elected chairman of the board of directors. Mr. Haggerson has been with the corporation more than 30 years and has been its president since 1944.

Bakelite, a division of Union Carbide, has appointed Leonard Connor retail sales promotion manager. As a graduate chemist, Mr. Connor is familiar with the technical as well as promotional aspects of the plastics industry. When he joined Bakelite in 1942, he first worked at its development laboratories in Bound Brook, N. J. After his war service he returned in 1947 to Bakelite to engage in publicity activities. Before coming to Bakelite he had been employed by E. I. du Pont de Nemours & Co., Inc., in the development of synthetic resins.

To Expand Acetylene Plant

Union Carbide plans to expand its Texas City, Tex., plant which has been in commercial operation for more than a year and uses a radically different chemical process for the production of acetylene. The method employed is a partial oxidation process involving the high-temperature reaction of methane and oxygen to form a gas mixture containing acetylene and other residual gases. Present plans call for a substantial enlargement of the plant, but are subject to the receipt of governmental priorities and certificates.

General Tire in Spain

The General Tire & Rubber Co., Akron, O., has acquired major interests in the Continental Fabrica Espanola del Coucho, S. A., of Spain.

William O'Neil, president of the General Tire, lately just back from an extended European business trip, announced the completion of the transaction on his recent visit to Torrelavega, Spain, where the company's plants are located.

The new General affiliate is Spain's second largest rubber manufacturing company. It produces mechanical goods in addition to tires and tubes.

General now has 12 affiliated and subsidiary companies outside of the United States and is considering several others.

Sales Personnel Reassigned

Seven members of General Tire's sales executive staff were given promotions in new assignments announced recently by L. A. McQueen, vice president in charge of sales.

These changes provide for the creation of a new northwestern division including the Portland and Denver branches and also name new managers in the Portland, Denver, and Boston branches.

Joseph S. Peixotto, Portland branch manager since 1937, assumes direction of the new division, and James W. Haggerty, northeastern division manager, has been promoted to the manufacturers sales department.

Earl Schaub, Denver branch manager, takes over the duties of the Boston manager; while David G. Gehring, former manager, goes to the Akron sales department for special assignments.

Peixotto's Portland post is to be filled by Robert G. Magnuson, former assistant manager; and Charles A. Briggs, new account salesman in the Chicago branch, has been given the Denver managerial job.

A. J. McPherson, Buffalo branch territory salesman, assumes the more important assignment of truck tire man for the Boston branch.

Peixotto, who joined General in 1928, continues his headquarters in Portland.

Haggerty's special assignments will take him into the Boston, New York, Philadelphia, Buffalo, and Richmond branches. He will continue his headquarters in Boston, where he joined General in 1928 after four years with General's Boston distributer. He was named Boston branch manager in 1932 and in 1950, northeastern division sales head.

Schaub previously had served as Buffalo and Denver managers. He came to General in 1938.

Gehring, who rounded out 20 years with the company last month, was appointed Boston branch manager in 1950.

Magnuson started with General shortly after returning from five years' military service.

Briggs began his career in the tire indutry in 1931.

McPherson has covered several territories in the Buffalo branch in his five years with the company.

Thomas F. O'Neil, vice president and director of the Don Lee-Yankee Networks, and vice president and a director of General Tire & Rubber Co., recently was elected chairman of the board of the Mutual Broadcasting System, Inc.

Brunkow Joins Hardesty

Howard Abbott, vice president and general manager of Hardesty Chemical Co., Inc., 41 E. 42nd St., New York 17, N. Y., manufacturer of plasticizers and sebacic acid, has announced the appointment of O. R. Brunkow as sales manager of the company. Dr. Brunkow, with 25 years' experience in the chemical industry, most recently was general sales manager for Commercial Solvents Corp.

Keltner, Others Advanced

Laurence R. Keltner has been named director of employe relations of The B. F. Goodrich Co., Akron, O., reporting to J. W. Keener, vice president. Mr. Keltner was manager of the Goodrich tire plant in Los Angeles, Calif., since 1947.

Keltner, 49, has been with the company 25 years. In his early days he was an analytical chemist, research physicist, and heat and curing engineer. After serving as a compounder in the tire division, he became assistant technical superintendent and handled many special assignments during World War II. Named superintendent of the Akron tire division in 1945, He served two years before being transferred to Los Angeles.

In his new position Mr. Keltner will be responsible for Goodrich employe relations activities throughout the company's operations. The position is newly created, in which Keltner will assume responsibilities in this field formerly carried by Vice President Keener.

James F. Sweatt, manager of Goodrich tire plant at Oaks, Pa., since 1943, has been named manager of the Los Angeles tire plant, to succeed Mr. Keltner. Mr. Sweatt joined the company in 1923 as a factory employe, was transferred to Los Angeles as supervisor when the plant was opened in 1928, and remained there until 1943, when he became manager of the Oaks plant.

Colin M. Stewart, since 1945 general manager of Cia. Goodrich Cubana, Havana, is now a member of Goodrich's automotive, aviation, and government sales division in Detroit. Stewart started with Goodrich in 1934 in the truck and bus tire sales department.

Charles H. Schroeder has been appointed technical manager of textiles in the industrial products division, succeeding the late Clarence W. Brees. Schroeder has been with Goodrich since 1921, when he joined the research department as a chemist. He became a technical man in the company's general molded goods department five years ago.

Changes in the staff of International B. F. Goodrich Co., which handles overseas operations of the parent company, were announced last month by W. C. Gulick, president.

George Low has been named operating manager, succeeding John R. Watkins, now operations and credit manager of International Rubber Co., Manila, Philippine Islands, a subsidiary sales company.

Low, with Goodrich six years, was in the field auditing department. Watkins joined the company in 1946 after service in the Navy.

Company Developments

An inflated rubber radar dome capable of withstanding 120-mile per hour winds, as well as heavy accumulations of ice and snow, has been completed by Goodrich for the Air Force. The structure stands 37 feet high, is 54 feet in diameter, contains 60,000 cubic feet of space, and requires more than 1,200 pounds of rubber and 90 gallons of rubber cement. The thin walls, constructed of a specially compounded rubber and Fiberglas, are inflated with less than one pound per square inch of air pressure. Nylon and rayon fabric will be used in other domes. The dome will be used to house aircraft warning equipment being installed on the Arctic rim of the North American continent.

Airplane tires used on World War II combat aircraft could not get today's faster and heavier jet fighters and bombers off the ground, let alone land them safely, according to T. G. Graham, Goodrich vice president. Tire designs which did a good job on military aircraft only a half dozen years ago are now obsolete. The heaviest load supported by airplane tires during the last war was the 35,000 pounds resting on each tire of the B-29 bomber, but the new jet bombers need tires strong enough to support 60,000 pounds each. New designs, new methods, and new rubber compounds produced such tires, Mr. Graham said. New rubber compounds were developed to resist destructive internal heat build-up at take-off speeds averaging 50% higher than those of the last war. Another postwar development, the extra-high-pressure airplane tire featuring a small cross-section with large diameter, made it possible for planes to fly at supersonic speeds. Conventional tires could not fold into the narrow airplane wing required for such speeds, but the new tire takes inflation pressures up to 300 pounds per square inch and fits into the thin wing. Mr. Graham stated that all airplane tires made now withstand cold temperatures down to —65° F., remain flexible at low temperatures, and do not develop flat spots when supporting the weight of the plane.

Laurence R. Keltner

Continental Appointments

Continental Carbon Co. has made Harry L. Ericson chief chemist of its new laboratory at 1440 W. 10th Ave., Amarillo, Tex. Previously Mr. Ericson had been with Witco Chemical Company's research laboratories in New York and Chicago and has had long experience in the rubber industry.

Continental also has named T. A. Ruble as technical supervisor. He was formerly with the research department of Phillips Petroleum Co.

Golf Ball Manufacturers' Association at its recent meeting in New York, N. Y., elected the following officers: president, L. E. Coleman, A. G. Spalding & Bros.; vice president, John Sproul, United States Rubber Co.; Vincent Richards, Dunlop Tire & Rubber Corp., secretary-treasurer.

Expanding Operations

The mechanical goods division of United States Rubber Co., Rockefeller Center, New York 20, N. Y., has announced the receipt of orders totaling over $30,000,000 for the manufacture of self-sealing fuel cells for B-29 and B-47 bombers, and rubber tracks for tanks and other tracked army vehicles. Both types of products will be made in the division's Fort Wayne, Ind., plant where the fuel cells are already in production. Experimental tank tracks have been made, and large-scale production was scheduled to begin late in May, according to E. G. Brown, vice president and general manager of the division. Special equipment consisting of new presses and a huge vulcanizer, 45 feet long and 15 feet high, have been installed at Fort Wayne to handle the additional production.

Other defense products being made at Fort Wayne include motor mountings for aircraft, jeeps, and electronic equipment; tank skirts; ammunition rack assemblies; bushing for combat trucks; impeller gears for water pumps on landing craft; and hundreds of rubber-to-metal specialties.

The division has also leased a factory at Decatur, Ind., about 20 miles from Fort Wayne, as a result of the demand for increased production for defense. The Decatur facility at present is used for the storage of defense production materials.

U. S. Rubber recently formally opened its new branch office and warehouse at 900 S. Jefferson Davis Parkway, New Orleans, La., with an open house reception and a guided tour of the building, which will be headquarters for distribution of all company products for Louisiana as well as parts of Alabama, Florida, and Mississippi. E. J. Espenan is operating manager.

Changes in Personnel

Willard deCamp Crater has been named manager of Marvinol vinyl resins for Naugatuck Chemical. He will develop new markets for vinyl resins and direct sales activities, with quarters at the Naugatuck, Conn., plant. Mr. Carter joined the division in December, 1949, after wide experience in plastics research and manufacturing with Hercules Powder Co., Federal Telephone & Radio Corp., and Glenn L. Martin Co. He holds numerous patents in plastics used in the wire and cable industry and other fields. He is a member of the New York and Washington Rubber groups and past president of the Baltimore-Washington Section of the Society of Plastics Engineers.

Noel E. Williams has been appointed industrial relations manager of Winnsboro Mills, Winnsboro, S. C. Mr. Williams joined the company at Winnsboro in December, 1943, and served successively as employment supervisor, industrial relations supervisor, and personnel supervisor at the mills.

John A. Boll has been appointed sales manager of Fisk-Gillette tires division, to succeed the late A. G. Westlund. Mr. Boll from 1930 to 1935 was manager of tire credits at the Detroit plant of U. S. Rubber and was again at Detroit from 1944 to 1946 as manager of the automotive sales department and from 1946 to 1948 was divisional manager for U. S. Tires. Next he became assistant manager of the U. S. franchise department in New York. His most recent assignment was assistant sales manager of the Fisk-Gillette tires division, a position which he assumed in September, 1950.

That position is now being filled by Lucian B. Lillie.

The U. S. Tires division has appointed W. L. Clarkson, Jr., district manager at Fargo, N. D. Mr. Clarkson, who started with the company in 1937, has held many positions of responsibility in its sales organization. He succeeds D. R. Bailey, who has been assigned to other duties.

Joseph H. Green has retired as sales manager of the Eureka Fire Hose division after 46 years of service. He began with Eureka Fire Hose Co. in April, 1905, as an office boy and rose through the ranks to the presidency of the corporation. When Eureka was dissolved and became a division of United States Rubber Co., Mr. Green became sales manager.

He is succeeded by Jonas R. Smith, manager for Eureka in the Philadelphia territory. Mr. Smith joined the company in 1920 as a Eureka salesman and was appointed branch manager in 1926, succeeding his late brother, John A. Smith.

Robert W. Ware succeeds Mr. Smith at Philadelphia, where the former started as a salesman in 1932. During World War I he did special work on tank tracks and synthetic rubber and at the close of the war returned to the Philadelphia sales organization.

The retirement of Miss W. May Matthews, assistant to Mr. Green and a veteran of 44 years with the company, has also been announced.

New "Movie" on Rubber

A new 16-mm. sound motion picture, "Speaking of Rubber," starring William Harrigan, has been produced by U. S. Rubber and is now available for showing to community groups, schools, lodges, and other organizations. The film has a running time of 27 minutes and deals with the importance of rubber in our daily lives. It includes scenes of the Far East rubber plantations, the production of synthetic rubber, the building and testing of tires, the manufacture of waterproof footwear, and the use of rubber in transportation, sports, industry, and national defense.

New Products Developed

A new wire reinforced rubber and fabric rotary hose for high-pressure oil-well drilling operations has been developed by U. S. Rubber and will be marketed under the trade name, U. S. Royal 4 Rotary Hose. Wire reinforcement and its fabric and rubber construction provide the hose with strength to withstand the pressures of the heaviest pumps in the oil fields, while retaining the flexibility and kink resistance needed for efficient drilling operations. The new hose will drill a well from top to bottom regardless of the pump pressure required or gas pressure encountered and eliminates the need of transferring from rubber to steel hose in high-pressure operations.

Naugatuck Chemical Division has developed Aramite, a new non-toxic chemical to kill mites, tiny bugs which have become a widespread problem for fruit growers, nurserymen, chicken farmers, and home gardeners. Mites, of which there are more than a dozen varieties, are not killed by organic insecticides such as DDT and have had a virtually uncontrolled growth. The new mite-killer developed by Naugatuck has been tested throughout the country by agricultural experiment stations with outstanding results and will be available to commercial growers for the first time this year.

To Expand Plants

A $100,000,000 financing plan for The Goodyear Tire & Rubber Co., Akron, O., was approved recently at a meeting of preferred stockholders. By a vote of 76% of the outstanding preferred stock, the company was authorized to increase its funded debt by that amount in addition to the $95,001,000 now outstanding. More than 98% of the stock represented at the meeting voted in favor of the proposal.

Following the meeting the company announced that it would proceed with its plans to borrow the entire $100,000,000 on 20-year 3½% unsecured notes from the insurance companies holding its present notes.

The new money will be used for capital expenditures in carrying out the company's general plans for expansion and improvement of plants to provide the productive capacity needed to meet the steadily increasing demand for Goodyear products.

Silver Jubilee of Textile Mill

The twenty-fifth anniversary of Goodyear's Cedartown, Ga., textile mill, first tire-cord fabric operation in the Southeast, was celebrated May 12 with a parade, barbecue, and open house. President E. J. Thomas also addressed employes and their families and awarded lapel pins to 12 workers who have served the company 25 years.

Goodyear's pioneer venture in the South, Clearwater Mill Number One at Cedartown, was opened April 15, 1926. About 300 employes produced just over a million pounds of tire fabric the first year. Today the mill employs almost 1,400, and last year's record-breaking production reached 28 million pounds of tire cord fabric.

Other Goodyear Announcements

An elaborate new promotional campaign is being staged by Goodyear to stimulate interest in bicycling, thereby increasing sales of bikes and bike tires. Designed to aid both Goodyear bicycle tire jobbers and their dealers, the program consists of a series of monthly mailings direct to these dealers to back up the company's national program of bike tire advertisements. Other features of the promotion include special display packages for dealers, window and door transparencies, wall charts, and reprints of national ads.

Goodyear has announced the installation of electrically heated anti-icing equipment on the Canadian Avro Jetliner, said to be the first jet powered commercial plane in North America. According to E. M. Eickmann, manager of Goodyear's aviation products division, the anti-icing equipment, termed Iceguards, consists of resistance wire elements mounted into an erosion-resistant synthetic rubber compound and is installed on the leading edges of the plane's wings, cabin air intakes, and horizontal and vertical stabilizers. The Iceguards are about 1/10-inch thick and extend about 30 inches around the leading edge of each surface. The center lines of each wing and tail leading edge are heated continuously to keep them free from ice at all times; while the adjacent areas are heated intermittently to break ice loose after allowing it to form a slight build-up.

Personnel Notes

C. H. Maxwell for the past three years production superintendent of Airfoam operations at Plant 3, has been named plant manager of the general products division, Plant C, where most of the company's Airfoam and Pliofilm are produced. Maxwell succeeds H. R. Child, recently returned as plant manager of the Hoosier unit of Indiana Arsenal, Charlestown, Ind. Mr. Maxwell, with Goodyear since 1927, was transferred in 1930 to Australian operations as a division superintendent; he returned in 1946 to become development manager of chemical products, moving to Airfoam in 1947.

Whitley P. McCoy, prominent labor arbitrator and professor of law at the University of Alabama, has been retained as impartial umpire for the hearing of labor grievances by Goodyear and the URWA, CIO.

Michael J. Gress, in various capacities in wholesale field operating at Goodyear since 1928, was appointed manager of the department to succeed G. L. Wright, resigned.

W. P. McCann, chief clerk in the Philadelphia district sales office, and L. A. Taylor, acting district operating manager at Newark, N. J., have been named to the staff of the wholesale field operating department at Akron. McCann replaces T. W. Kirkwood, recently transferred to Salt Lake City, Utah, as district operating manager. Taylor takes the place of W. R. Bryan, who has moved to Goodyear's accounts payable department as chief clerk.

Jefferson Chemical Co., Inc., 711 Fifth Ave., New York 22, N. Y., has made George L. Innes assistant sales manager and has added John R. Carlson to its sales department.

The R. C. A. Rubber Co., Akron, O., at its recent directors' meeting elected the following officers: C. E. Reiss, chairman of the board; R. T. Reiss, president and treasurer; F. W. Todd, vice president; Miss E. V. Phelps, secretary.

New York Quartermaster Procurement Agency, 111 E. 16th St., New York 3, N. Y., recently announced the awarding of the following contracts: for inflatable sleeping pads, 2,000 at $17.10 each, New York Rubber Corp., New York; 40,000 at $19.48 each, Hodgman Rubber Co., Framingham, Mass.; 70,000 at $19.92 each, The B. F. Goodrich Co., Akron, O.; 88,000 at $21.62 each, United States Rubber Co., Providence, R. I.; firemen's rubber boots, 4,980 pairs at $8.36-8.50 each, U. S. Rubber, Naugatuck, Conn.; shoepacs, Goodyear Rubber Co., Middletown, Conn.; U. S. Rubber, Naugatuck; Mishawaka Rubber & Woolen Mfg. Co., Mishawaka, Ind.; Hood Rubber Co., Watertown, Mass.; Bristol Mfg. Corp., Bristol, R. I.; Rubber Corp. of California, Garden City, Calif.; Converse Rubber Co., Malden, Mass.; for women's rubber overshoes, Bristol Mfg.; U. S. Rubber, Naugatuck; for rubber hip boots, Tyer Rubber Co.; Andover, Mass.; U. S. Rubber, Naugatuck; short rubber boots, Hood; Converse; U. S. Rubber, Naugatuck; Bristol Mfg.; Cambridge Rubber Co., Tarreytown, Md.; men's high overshoes, La Crosse Rubber Mills Co.; LaCrosse, Wis.; Rubber Corp. of California; Hood; for waterproof bags, U. S. Rubber, Providence; half tap rubber-composition soles, to Goodyear Tire & Rubber Co., Akron; O'Sullivan Rubber Corp., Winchester, Va.; for full rubber soles, Bearfoot Sole Co., Inc., Wadsworth, O.; Goodrich.

WEST

Thomas Monsanto President

One of the nation's leading atomic scientists, Charles Allen Thomas, recently was elected president of Monsanto Chemical Co., St. Louis, Mo., to replace William M. Rand, who retired under the company pension plan.

Dr. Thomas, Monsanto's executive vice president since 1947, began his career with General Motors, aiding in the development of ethyl gasoline, and later established research laboratories in Dayton, O. The laboratories were acquired by Monsanto in 1936, and Dr. Thomas became the company's research director. He then moved up through successive positions to the presidency.

Mr. Rand, who continues on Monsanto's board, entered the organization in 1921 through the Merrimac Chemical Co., Everett, Mass., serving in successive executive positions, including the presidency. Merrimac was acquired by Monsanto in 1929, liquidated as a separate corporation in 1937, and thereafter operated as Monsanto's Merrimac Division. With this change, Mr. Rand was made division general manager and a Monsanto vice president. In 1943 he became a member of the executive committee and was transferred to St. Louis. He was elected president of Monsanto on October 1, 1495.

Expanding Research Facilities

Monsanto has announced substantial expansion of research facilities at its rubber service department plant at Nitro, W. Va., according to John L. Gillis, vice president of Monsanto and recently appointed general manager of the organic chemicals division.

The research building is part of a major expansion program for the division, Mr. Gillis stated.

The new research facility will provide the local plant with an air-conditioned, two-story, brick and steel structure. The building will house laboratories, conference rooms, offices, and improved library and storage facilities for activities in the field of rubber and agricultural chemicals, oil additives, and synthetic detergents. Construction of the new unit is expected to begin soon, with completion scheduled for the Spring of 1952.

Monsanto this year is celebrating its fiftieth anniversary. The Nitro plant, founded in 1921, was acquired when Monsanto purchased the Rubber Service Laboratories Co. in 1929.

Plastics Plant for Brazil

Monsanto has organized a new subsidiary company in Sao Paulo, Brazil. The new firm, Monsanto S. A. Produtos Quimicos E Plasticos, has been formed by Monsanto and a group of Brazilian interests. The new company will construct plants, probably in the vicinity of Sao Paulo, for the manufacture of vinyl chloride monomer and Ultron polyvinyl chloride resins and compounds, according to Mr. Thomas. The new plant will have sufficient capacity to meet all immediate foreseeable Brazilian market demands. Construction will start in the near future, and all units should be in production in the latter part of 1952. The new firm will be the first to produce vinyl chloride in South America.

Charles Allen Thomas

American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., has announced that construction will soon be started on a building in Los Angeles, Calif., that will be leased to house the company's offices and warehouses now scattered in a number of locations in Los Angeles and Azusa. Scheduled for completion by September 1, the one-story building will contain 44,000 square feet of warehouse space and 20,000 square feet of air-conditioned offices. Additional land at the site affords room for expansion at a later date, if required. Among the company units which will use the new facilities are Calco Chemical division's pigment department and bulk pharmaceutical department, the industrial chemicals division, the plastics and resins division, and the Lederle Laboratories division's branch office and regional sales office. Cyanamid's West Coast executive offices, now at Azusa, will also be in the new building.

Rubber Teck, Inc., 19115 S. Hamilton St., Gardena, Calif., recently completed a new office building and machine shop. Other additions to its facilities are contemplated by the company, which manufactures mechanical rubber goods and solid industrial tires.

Frank B. Wolcott

Adams, Endacott Advanced

At the recent annual meeting of Phillips Petroleum Co., Bartlesville, Okla., K. S. Adams, president of the company since 1938, was elected chairman of the board, chief executive officer, and chairman of the executive committee. The position of chairman had been vacant since the retirement of the late Frank Phillips in 1948.

Paul Endacott was elected president. Mr. Endacott, as executive vice president and assistant to the president, has been the operating manager of the company and continues in that capacity.

Stanley Learned was elected executive vice president and assistant to the president.

W. W. Keeler, vice president of refining, was elected a director and vice president and assistant to the executive vice president.

C. C. Tate was appointed manager of the refining department, and J. E. Bogk, chairman of the operating committee.

Phillips Chemical Co., Bartlesville, Okla., revealed a new development said to permit increases in capacity of government-owned synthetic rubber plants by up to 20% with only minor changes. For some time it has been known how to produce synthetic rubber by faster reactions than those normally used, but plant equipment could not remove the great amount of heat generated. Phillips engineers recently devised a means of inserting cooling coils in the present reactors to remove the heat faster, and on plant-scale runs rubber was made in eight hours instead of the usual 12-14 hours. Full use of the new development by the operators of synthetic rubber plant should increase the capacity of the plants with only moderate additional expenditures.

California Rubber Products, Inc., manufacturer of hard rubber, household, mechanical, sponge rubber, and stationers' goods, 130 N. Hawthorne Blvd., Hawthorne, Calif., is building a 10,000-square-foot addition to its duct department.

Wyandotte Appointments

Paul M. Bigley, assistant general sales manager, Michigan Alkali Division, Wyandotte Chemicals Corp., Wyandotte, Mich., has been appointed to serve with the Economic Stabilization Agency and has been granted a leave of absence by the company.

Thomas R. Boyle, now administrative assistant to the general sales manager, has assumed all duties normally handled in the past by Mr. Bigley.

Frank B. Wolcott has been named manufacturing manager of Wyandotte Chemicals, where he will have supervision over the company's chemical, compounding, quarrying, mining, and transportation activities, most of which are in process of expansion.

A native of Cleveland, O., the 44-year-old Wolcott joined New Jersey Zinc Co. as an engineer in 1930 in its mines in West Virginia, but in 1933 was transferred to the Palmerton, Pa., works where he was, successively, in charge of slab zinc and metal manufacturing, until he became superintendent of the plant in 1948.

The Baker Castor Oil Co., 120 Broadway, New York 5, N. Y., has announced that its sales in St. Louis and immediate vicinity are now handled exclusively by Harry A. Baumstark & Co. To assure prompt deliveries a complete stock of Baker products will be warehoused at St. Louis by the new sales agent.

Dow-Elco Co. is erecting a specialty plant on Whittier Blvd., Los Angeles, Calif., for bonding rubber to metal and some machine operations.

Ben Trower recently was advanced to office manager and purchasing agent for Bettis Rubber Co., which specializes in oil well products, 1557 S. Esperanaza St., Los Angeles 23, Calif.

OBITUARY

Wm. T. Bell

WILLIAM T. BELL, 61, manager of distributer sales for the mechanical goods department of The Goodyear Tire & Rubber Co., died suddenly of a heart attack April 22 at Houston, Tex.

With the company more than 38 years, Mr. Bell handled positions as Chicago district mechanical goods office manager and sales engineer prior to his appointment in 1919 as manager of hose sales and manager of railroad sales, Akron positions he held until his appointment as manager of distributer sales in 1941.

Before joining Goodyear Mr. Bell had been with the Diamond Rubber Co. and the B. F. Goodrich Co.

A graduate of Northwestern University, he was a Scottish Rite 32nd degree Mason and a member of the Independent Order of Odd Fellows and of Grace Reformed Church.

Surviving are the widow and a daughter.

D. R. Burr

D. R. BURR, 77, retired former consulting manager of the mechanical goods sales department at The Goodyear Tire Rubber Co., died at Ft. Lauderdale, Fla., April 20.

Long known as the dean of the company's mechanical goods sales department, Mr. Burr joined Goodyear from the Diamond rubber Co. in 1913 as division manager in mechanical goods sales. He was appointed assistant manager of the division in 1916, spending two years with the export division to establish a mechanical goods sales department in Australia and New Zealand. He returned to Akron in 1919 and in 1920 was appointed manager of the department, handling that position until 1933, when named consulting manager. He was pensioned by the Goodyear company in 1938.

A native of Columbus, O., Mr. Burr attended Ohio State University.

He is survived by his wife and a daughter.

Funeral services were held at Ft. Lauderdale on April 22.

David C. Scott

David C. Scott

AFTER a long illness David C. Scott, well-known authority in the field of physical testing and president of Scott Testers, Inc., Providence, R. I., died there May 12 at the age of 66.

Mr. Scott was an officer of Scott Testers and its predecessor company, Henry L. Scott Co., since 1900 and its president since 1936. He also authored many papers relating to testing and held numerous patents in this field. During World War I he acted as technical adviser to the Army Air Corps.

The deceased held membership in the Textile Institute, Manchester, England; Textile Research Institute; American Society for Testing Materials; Division of Rubber Chemistry, American Chemical Society, its Twenty-Five Year Club, and several local rubber groups; Society for Experimental Stress Analysis; American Society of Mechanical Engineers; and the American Association of Textile Colorists & Chemists. He also belonged to the Chemists' Club of New York, the British Empire Club of Providence, Rhode Island Yacht Club, and the Afterguard of the Intercollegiate Yacht Racing Association of North America. In activity on behalf of conservation he was associated with various wild life and sportsmen's groups.

Mr. Scott, a 32nd degree Mason, was affiliated with the Order of Scottish Rite, the Roger Williams and Mt. Vernon Lodges, St. Johns' Commandery, and Palestine Temple.

Surviving are his wife, a daughter, two sons, a sister, and six grandchildren. His two sons, James M. and David C. Jr., have long been officers of Scott Testers.

Richard H. Newell

RICHARD H. NEWELL, factory manager, Wilsolite Corp., Buffalo, N. Y., died suddenly at his home on April 8. He had a broad experience in the rubber industry not only in the East, but also in the Los Angeles area. Among his past associations were Fisk Rubber Co., Quaker Rubber Corp., Gates Rubber Co., and Rubbercraft Corp. of California.

A veteran of World War I, Mr. Newell also belonged to the Masons and The Los Angeles Rubber Group, Inc.

He leaves a wife and a daughter.

CANADA

Rubber Use Increases

Rubber consumption in Canada during February totaled 8,051 tons, including natural rubber, 4,339 tons; synthetic, 2,225 tons; and reclaimed rubber, 1,487 tons. During February, 1950, 6,390 tons of rubber were consumed as follows: natural rubber, 3,690 tons; synthetic rubber, 1,630; reclaim, 1,070 tons.

Stocks on February 28, 1951, were 8,794 tons, including 4,153 tons natural, 2,676 synthetic, 1,965 reclaim. The respective figures for February 28, 1950, were 10,959 tons, 4,964, 4,300, and 1,695 tons.

Dominion production of synthetic rubber reached 4,726 tons in February, against 4,345 tons in the 1950 month. Reclaimed rubber output amounted to 460 tons in February, 1951, compared with 291 tons in February, 1950.

Consumption in March amounted to 8,498 tons, compared with 6,738 a year earlier. Consumption of natural rubber totaled 4,626 tons, against 3,916, synthetic 2,263 tons, against 1,683, and reclaim 1,609 tons, against 1,139.

Domestic production of synthetic and reclaim rubber amounted to 5,762 tons, against 5,612, comprising 5,276 tons of the former, against 5,290 in March, 1950, and 486 tons of the latter, against 322 tons. Month-end stocks of all types amounted to 10,046 tons, against 10,700. Inventories of natural rubber totaled 4,990 tons, against 4,983 on March 31, 1950; synthetic 3,011 tons, against 4,110; and reclaim 2,045 tons, against 1,607.

Explosion at Polymer Corp.

An explosion and fire rocked the Polymer Corp., Ltd., synthetic rubber plant at Sarnia, Ont., on May 6. The explosion occurred in a tank of butadiene steroil, a highly volatile by-product of the synthetic rubber process, and set off a fire that was brought under control within an hour by plant firemen. The blast and fire destroyed about 1,000 square feet of the plant, but there were no fatalities and only a few men were injured. The explosion was the second at the plant in little more than a year, but damage was said to be considerably less than the original estimate of $50,000-100,000 made by Canadian Minister of Production C. D. Howe. According to H. H. Rowzee, Polymer plant manager, the unit for extracting butadiene steroil will be back in production within three weeks, and damage to an adjacent building, which held up production of synthetic rubber, would be repaired within 24 hours.

Protest Tariff Reductions

Tariff reductions announced in the House of Commons on May 9 met with varied reactions from Canadian manufacturers affected by the changes. Greig B. Smith, manager of the Rubber Association of Canada, said that the lowered tariff on rubber tires and hose is unwelcome.

"Canada is right next door to the biggest rubber industry in the world in the United States," Smith said. "There has always been a certain amount of difficulty with U. S. competition."

NEWS ABOUT PEOPLE

Ralph F. Wolf, manager, compounding research, Columbia Chemical Division, Pittsburgh Plate Glass Co., Barberton, O., has been appointed consultant to the rubber division, Defense Production Administration, Washington, D. C. He is reported on loan to the government for a three-month period. During World War II, Mr. Wolf was chief of synthetic rubber allocations for the rubber bureau of the War Production Board.

J. Wurtz, chief chemist of Arrowhead Rubber Co., 2244 E. 37th St., Los Angeles 11, Calif., has been advanced to the position of product engineer.

Robert A. Lees, manager of the Akron, O., laboratories of American Anode, Inc., has been loaned to the National Production Authority as an adviser on the allocation of liquid latex. Lees, an adviser to the Rubber Bureau during WPB, has been with the company 22 years. In 1946 he supervised the building of Anode's plant in California and was plant manager there until October, 1949, when he returned to Akron as manager of research and development. He assumed his present position in January, 1951.

W. Rudko, technical superintendent of The Thermoid Co. at Nephi, Utah, recently resigned to join F. H. Maloney Co., manufacturer of mechanical rubber goods at Houston, Tex.

Alfred J. Oxenham has been made technical representative in the product development department of Pittsburgh Coke & Chemical Co., Grant Bldg., Pittsburgh, Pa., and will be concerned with the company's market research program and new product sales development. After service in the Navy, Mr. Oxenham joined Merrimac Division of Monsanto Chemical Co. in 1946, as a sales representative in the New York district office.

Lester K. Ross, vice president of Charles Ross & Son Co., Brooklyn, N. Y., manufacturer of mixing, grinding, kneading, and milling equipment for the rubber industry, has taken over sales representation for the Great Lakes Region. He will make his home at 88 South St., Cuba, N. Y.

George C. Sheldon has been appointed sales manager of American Resinous Chemicals Corp., Peabody, Mass. Mr. Sheldon's entire career has been spent in the field of selling and sales management, first with General Tire Co., where he was sales manager for ten years, and then vice president and general manager. He next joined Union Bay State Chemical Co. as sales manager, a position he held 6½ years. Following this he became sales manager of General Latex & Chemical Corp.

J. Douglas Dawson, traffic manager of the abrasive division, Norton Co., Worcester, Mass., has been named general traffic manager to succeed **Elmer B. Jones,** retired.

Kaiden-Kazanjian

Warren A. Beman

Warren A. Beman, staff member in charge of textile work for the chemical products division of Socony-Vacuum Oil Co., Inc., 26 Broadway, New York 4, N. Y., has been appointed to direct chemical products development for the company. Prior to his transfer to New York, Mr. Beman worked in refinery engineering, the development section of Socony-Vacuum Laboratories, and in field technical sales and service.

A primary function of Socony-Vacuum's new activity will be to coordinate the company's development program on all chemical products by working closely with the research and development heads of other leading companies in the paper, textile, plastic, rubber, and chemical fields. This is expected to make available to industry perfected complementary processing materials at the same time new products in these fields are released.

Edmund F. Ball, president of Ball Bros. Co., Inc., Muncie, Ind., recently was elected a director of Borg-Warner Corp., Chicago, Ill., to succeed George A. Ball, his uncle, who has retired. Edmund F. Ball has been chief executive for three years of the company which bears his family's name. Previously he was executive vice president of the company, a post to which he was elected in 1945, when he was released from the army with the rank of major. The Ball organization operates seven plants in Muncie and seven subsidiary branch plants in other cities. The company manufactures glass containers, metal closures, rolled strip zinc, rubber products, and paper shipping containers.

Clement A. Damen has been appointed manager of Witco Chemical Co.'s Washington office, at 1111 17th Street N. W., Washington 6, D. C. As Washington representative of Witco's defense products division, Mr. Damen will serve as contact for the sales and manufacturing divisions. He has been with the Witco sales organization for 25 years and at one time was manager of the Boston office.

Joseph H. Rowe has joined the technical staff of the Natural Rubber Bureau Research Laboratory, Washington, D. C. Mr. Rowe specialized in asphalt concrete research with the materials testing laboratory of the Texas Highway Department, Austin, Tex. At the Bureau's laboratory he will concentrate on rubber road development work and will also lend his experience to the laboratory's general asphalt experiment programs.

Patrick Dolan has been named district manager of the newly established Baltimore, Md., office (1605 Court Square Bldg.) of The Patterson Foundry & Machine Co., East Liverpool, O. Mr. Dolan has been a sales engineer at the main offices for a number of years.

C. A. Litzler, president of Industrial Ovens, Inc., 13825 Triskett Rd., Cleveland 11, O., sailed on May 8 for a two-month visit to 19 major industrial centers in western Europe. He is scheduled to meet with officials of some 32 European industrial concerns before returning to the United States. Mr. Litzler is making the trip at the request of several European companies to consult with them regarding processing equipment developed by Industrial Ovens for use in the tire fabric and vinyl coating industries and the plastic jacketing of wire and cable. He will also inspect Industrial Ovens' equipment recently installed or in process of erection in a number of plants. Mr. Litzler's itinerary includes stays in Milan, Italy; Zurich and Lucerne, Switzerland; Hanover, Germany; Liege, Belgium; Amsterdam and Helmond, The Netherlands; Paris, Lyon, and Colombe, France; and London and Birmingham, England. He is scheduled to return on the *Queen Mary,* arriving in New York on June 27

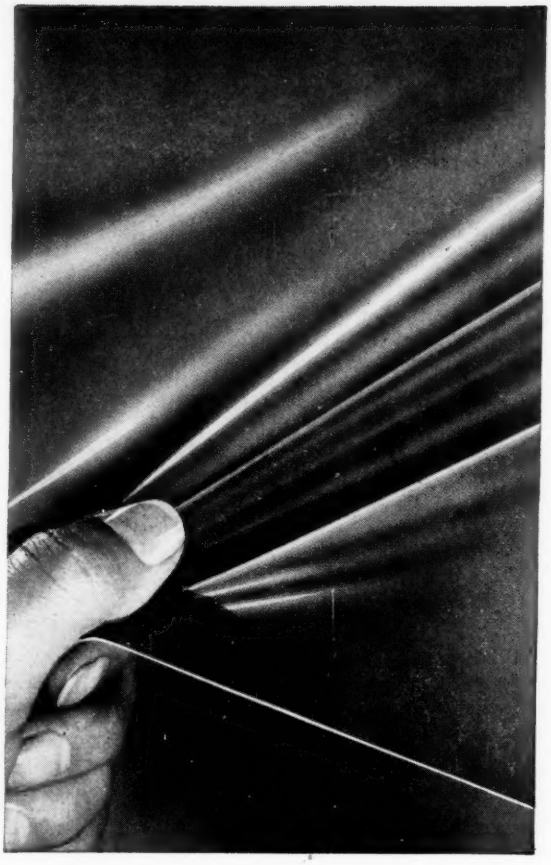
J. G. Hagey, advertising manager of B. F. Goodrich Rubber Co. of Canada Ltd., Kitchener, Ont., recently was elected president of the Association of Canadian Advertisers.

FINANCIAL

Allied Chemical & Dye Corp., New York, N. Y. Quarter ended March 31: net income, $11,043,280, equal to $1.25 a share, against $8,417,451, or 95¢ a share, in the 1950 period.

American Cyanamid Co., New York, N. Y., and subsidiaries. March quarter, 1951: net income, $9,535,981, equal to $2.80 each on 3,644,375 common shares, compared with $6,884,017, or $2.41 each on 3,072,710 shares in the 1950 quarter; net sales, $102,193,058, against $72,724,620; provision for income taxes, $15,500,000, against $7,300,000.

Belden Mfg. Co., Chicago, Ill. Three months ended March 31: net income, $303,840, equal to 95¢ a share, compared with $323,185, or $1.01 a share, in the 1950 period.



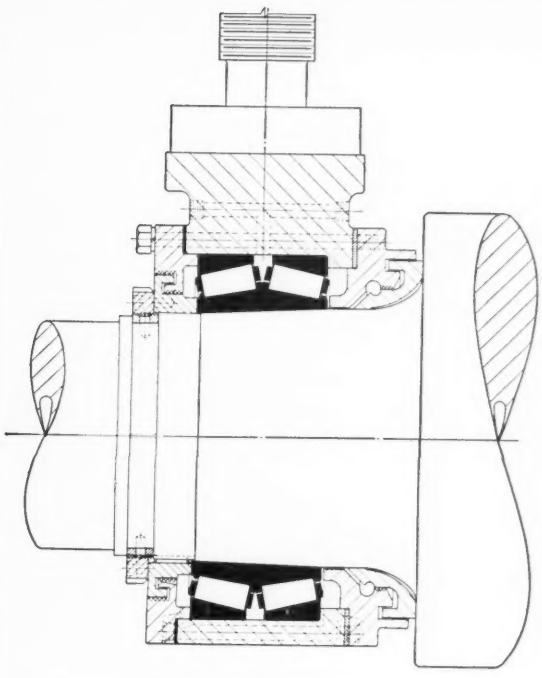


Diagram shows how calender rolls are mounted on Timken bearings to insure uniform sheets of plastic or rubber film.

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NOW you can get precision control of plastic and rubber film gage, eliminating variation in color shades. Timken® tapered roller bearings on your calender rolls give you uniform film thickness day in and day out, cut rejects to a minimum. And because Timken bearings maintain closer gage tolerances, there is less material wasted due to too-thick film.

Timken bearings may be properly adjusted to assure free rotation, without looseness, when the calender rolls come up to operating temperature—thus compensating for roll neck expansion and maintaining accurate control of gage. Furthermore, the adjustable feature of Timken bearings permits grinding of rolls on preloaded bearings, in chocks, to get minimum eccentricity.

With Timken bearings on your mill equipment, you can count on (1) uniform high quality in plastic and rubber film, (2) minimum maintenance costs, (3) fewer rejects.

For full information on Timken bearing applications for calenders, mills, refiners, and mixers, write The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN

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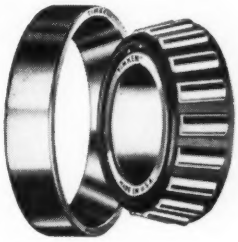
TAPERED ROLLER BEARINGS



NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST ↔ ◫ ↔ LOADS OR ANY COMBINATION ◫

American Wringer Co., Inc., Woonsocket, R. I., and subsidiaries. For 1950: net profit, $661,812, equal to $2.39 a share, against $456,338, or $1.65 a share, in 1949; net sales, $10,236,822, against $8,147,475.

American Zinc, Lead & Smelting Co., Columbus, O., and wholly owned subsidiaries. Twelve months ended March 31, 1951: net profit, $4,157,663, equal to $5.67 a common share, against $547,592, or 31¢ a share, in the preceding 12 months; net sales, $33,585,471, against $70,854,321.

Anaconda Wire & Cable Co., New York, N. Y. For 1950: net income, $5,265,266, equal to $6.24 a common share, against $3,734,528, or $4.42 a share, in the preceding year; net sales, $93,687,237, against $77,240,076.

Quarter ended March 31: net income, $1,620,896, equal to $1.92 a share, against $874,867, or $1.04 a share, a year earlier.

Borg-Warner Corp., Chicago, Ill. For 1950: consolidated net income, $29,027,224, a new high and equal to $12.16 a common share, against $22,046,885, or $9.16 a share, the year before; net sales, $330,924,422, another record, against $252,366,420.

March quarter 1951: net earnings, $5,777,475, equal to $2.40 a share, compared with $6,541,805, or $2.73 a share, a year earlier; sales, $100,600,870, against $70,656,559; provision for income taxes, $8,549,343, against $4,001,990.

Boston Woven Hose & Rubber Co., Cambridge, Mass. Six months ended February 28, 1951: net income, $754,357, equal to $8.31 a common share, against $139,712 a year earlier; net sales, $11,154,411, against $5,845,120; reserve for income and excess profits taxes, $798,171, against $99,151.

Brown Rubber Co., Inc., Lafayette, Ind. For 1950: net income, $1,472,944, equal to $3.91 a share, against $1,239,420, or $3.29 a share, the year before; provision for federal income taxes, $1,321,791, against $763,000; current assets, $2,191,448, current liabilities, $582,593 against $2,116,044 and $404,550, respectively, on December 31, 1949.

Brunswick-Balke-Collender Co., Chicago, Ill., and subsidiaries. For 1950: net profit, $2,412,116, equal to $5.08 a common share, contrasted with $1,780,391, or $3.67 a share, the year before; net sales, $29,599,659, against $27,773,522.

Philip Carey Mfg. Co., Cincinnati, O., and subsidiaries. March quarter, 1951: net profit, $815,688, equal to 99¢ a common share, compared with $394,414, or 46¢ a share, in last year's quarter; sales, $13,836,696, against $8,827,424.

Columbian Carbon Co., New York, N. Y., and subsidiaries. March quarter, 1951: net profit, $1,612,277, equal to $1.00 each on 1,612,218 capital shares, compared with $1,443,566, or 90¢ a share, in the corresponding period last year; sales, $12,648,409 against $10,972,861; provision for income taxes, $1,450,000, against $800,000.

Crown Cork & Seal Co., Inc., Baltimore, Md., and wholly owned domestic subsidiaries. Initial quarter, 1951: net profit, $1,064,119, equal to 77¢ each on 1,207,790 common shares, contrasted with $106,167, or 39¢ each on 275,000 preferred shares; net sales, $26,195,097, against $16,588,298; provision for federal income taxes, $866,490 against $16,827.

DeVilbiss Co., Toledo, O., wholly owned subsidiary. First quarter, 1951: net income, $207,860, equal to 69¢ a common share, against $78,142, or 26¢ a share, in last year's period.

Dewey & Almy Chemical Co., Cambridge, Mass. First quarter, 1951: net profit, $414,746, against $214,071 in the 1950 period; net sales, $7,125,801, against $3,908,382.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. First quarter, 1951: net income, $59,557,522, equal to $1.26 a share, against $54,510,004, or $1.15 a share, in the corresponding period of 1950.

General Cable Corp., New York, N. Y. Quarter ended March 31: net income, $1,251,490, against $307,961 in the like period last year.

General Motors Corp., Detroit, Mich. First three months, 1951: net income, $141,520,651, equal to $1.58 a common share, contrasted with $212,387,765, or $2.38 a share in last year's quarter; net sales, $1,959,879,617, against $1,642,659,449.

Glidden Co., Cleveland, O., and subsidiaries. Six months ended April 30, 1951: net profit, $4,380,241, equal to $2.10 a share, compared with $2,721,712, or $1.27 a share, a year earlier; net sales, $115,918,248, against $80,332,382; reserve for taxes, $3,985,000, against $1,669,700.

B. F. Goodrich Co., Akron, O. Initial three months, 1951: consolidated net income, $8,058,128, equal to $1.90 a common share, compared with $5,332,445, or $1.23 a share, in the preceding year's quarter; consolidated net sales, $157,728,418, against $104,264,454.

Hewitt-Robins, Inc., New York, N. Y. First three months, 1951: net earnings, $282,163, equal to $1.01 each on 278,814 common shares, contrasted with $127,875, or 46¢ a share in the like period last year; net sales, $8,395,120, against $4,460,713.

Jenkins Bros., Bridgeport, Conn. For 1950: net income, $652,581, equal to $4.97 a common share, against $237,283, or $1.55 a share, the year before; net sales, $12,355,818, against $8,994,248.

Koppers Co., Inc., Pittsburgh, Pa. Initial quarter, 1951: net income, $2,604,599, equal to $1.52 each on 1,617,125 common shares, against $1,794,554, or $1.02 a share, in the first quarter last year; net sales, $57,635,437, against $43,969,951.

Minnesota Mining & Mfg. Co., St. Paul, Minn. First quarter, 1951: net earnings $4,322,478, equal to 53¢ a share, against $4,379,065, or 54¢ a share in the 1950 quarter; sales, $44,358,553, up 37%.

National Automotive Fibres, Inc., Trenton, N. J., and wholly owned subsidiaries. First quarter, 1951: net profit, $1,522,140, equal to $1.53 a share, against $476,386, or 48¢ a share in the corresponding period of 1950.

New Jersey Zinc Co., New York, N. Y., and subsidiaries. First quarter: net profit, $2,571,243, equal to $1.31 each on 1,960,000 capital shares, against $297,547, or 15¢ a share, in the 1950 quarter.

(Continued on page 378)

Dividends Declared

Company	Stock	Rate	Payable	Stock of Record
Belden Mfg. Co.	Com.	$0.40 q.	July 16	July 2
Boston Woven Hose & Rubber Co.	Com.	0.50 q.	May 25	May 15
Brown Rubber Co., Inc.	Com.	0.40	June 1	May 18
Brunswick-Balke-Collender Co.	Com.	0.25	June 15	June 1
	Pfd.	1.25 q.	July 2	June 20
Crown Cork & Seal Co.	Com.	0.50 q.	May 15	Apr. 24
	Pfd.	0.50 q.	June 15	May 22
Dewey & Almy Chemical Co.	Com.	0.30 new	June 15	May 28
Faultless Rubber Co.	Com.	0.50 q.	June 25	June 15
Firestone Tire & Rubber Co.	Pfd.	1.12½ q.	June 1	May 15
Flintkote Co.	Com.	0.50 q.	June 9	May 26
	Pfd.	1.00 q.	June 15	June 1
General Tire & Rubber Co.	Com.	0.50 q.	May 31	May 21
Hewitt-Robins, Inc.	Com.	0.40 q.	June 15	June 1
Johnson & Johnson	Pfd. B	0.87½ q.	May 1	May 1
	Pfd. C	1.00 q.	May 1	May 1
	Com.	0.25 red.	June 11	May 28
Lea Fabrics, Inc.	Com.	0.37½	May 28	May 10
Lee Rubber & Tire Corp.	Com.	0.50 extra	May 1	Apr. 16
	Com.	0.75 q.	May 1	Apr. 16
Minnesota Mining & Mfg. Co.	Com.	0.25	June 12	May 22
	Pfd.	1.00 q.	June 12	May 22
National Automotive Fibres, Inc.	Com.	0.50 q.	June 1	May 10
Okonite Co.	Com.	0.25 q.	May 1	Apr. 16
Plymouth Rubber	Com.	0.12½ decr.	June 15	June 1
Seiberling Rubber Co.	Com.	0.25 q.	June 10	May 19
	Pfd.	1.12 q.	July 1	June 15
	Pfd. A	1.25 q.	July 1	June 15
Thermoid Co.	$2.50 Conv. Pfd.	0.62½ q.	May 1	Apr. 16
Tyer Rubber Co.	Com.	2.00	May 15	May 1
	Pfd.	1.06¼ q.	May 15	May 1
Union Asbestos & Rubber Co.	Com.	0.25 q.	July 2	June 8
United Elastic Co.	Com.	0.60	June 8	May 17
United States Rubber Co.	Com.	1.50	June 11	May 21
	8% Pfd.	2.00	June 11	May 21
Viceroy Mfg. Co., Ltd.	Com.	0.25	June 15	June 1
White, S. S., Dental Mfg. Co.	Com.	0.37½ q.	May 15	Apr. 30
Whitney Blake Co.	Com.	0.15 irreg.	May 10	May 1

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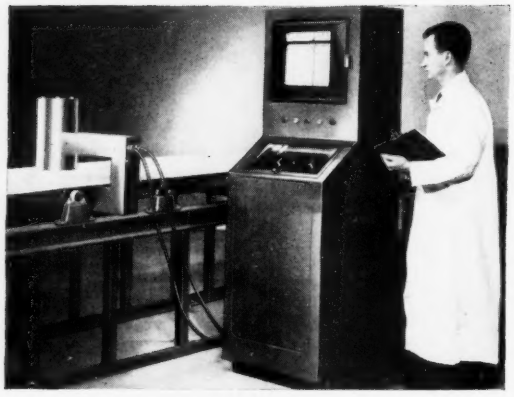
New Machines and Appliances



New Beta Ray Thickness Gage
Made by Industrial Nucleonics

Beta Ray Thickness Gage

A NEW beta ray gage for continuously recording variations in thickness or weight per unit area of a wide variety of moving sheet materials in the production line has been announced by Industrial Nucleonics Corp., Columbus 12, O. Steel, aluminum, brass, rubber, plastics, and coated textiles are among the materials which can be measured with the new instrument. Advantages of the gage are ability to measure accurately and continuously to a few millionths of an inch without contacting the material being gaged; ability to operate continuously without any standardization or recalibration by plant personnel; insensitivity to steel composition changes; and high degree of stability to temperature variations, dirt, moisture, shock, and vibration.

The gage utilizes radioactive materials and has as its basic components a beta radiation source, a radiation detector, and a recording device. The material being measured is run through a gap between source and detector, and direct readings in terms of thickness can be made on materials of constant density. The U-shaped mount holding the source box and radiation detector-amplifier unit is made from heavy welded steel beams. The hermetically sealed beta radiation source capsule is protected by a ¼-inch thick welded steel housing and provided with an electrically operated shutter mechanism to assure personnel safety.

Tensile High?
SEE PAGE 256

a combination to extend and improve your compounds

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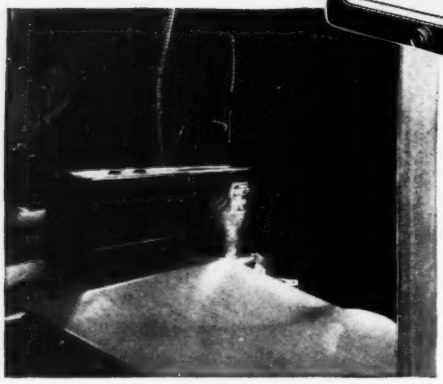

The Verigraph Weight Recorder applies the speed and accuracy of electronics to weight recording. Simple to install and operate. This exclusive Foxboro development has been in use by leading companies on critical calendering since 1926.

Moving sheet is electronically weighed by passing between 2 capacitor plates.

You get a continuous, accurate record of the weight of calendered stock, when your calenders are equipped with the Foxboro Verigraph.*

Regardless of temperature, speed, roughness, or other normal conditions of the material, the Verigraph gives you a precise weight measurement *without contacting* the sheet! The sheet moves between precisely spaced capacitor plates, and the exclusive electronic measuring circuit makes readable records of thickness variations as small as .0001". Such accuracy reduces rejects, improves uniformity, and can save many tons of material annually.

Verigraph Recorders are now in daily use at leading rubber and plastics companies throughout the world. Write for information. The Foxboro Company, 626 Neponset Ave., Foxboro, Mass., U.S.A.

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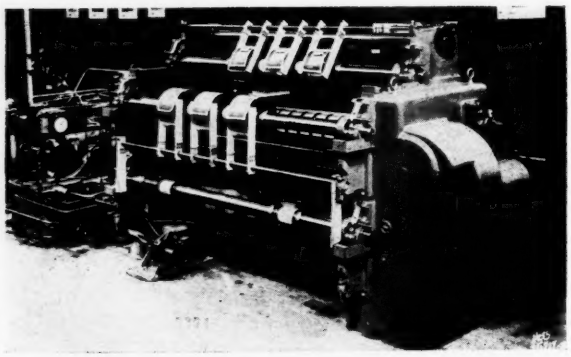
The floor mounted console is made of 14-gage steel and houses an electronic strip chart recorder, three highly regulated power supplies, reference batteries, and an automatic standardizing control mechanism.



Camachine Triplex Slitter-Rewinder for Acetate Film

Slitting and Rewinding Machine

THE Camachine Triplex, a new slitting and rewinding machine for use in converting acetate film, has been announced by Cameron Machine Co., 61 Poplar St., Brooklyn 2, N. Y. Shown for the first time at the recent National Packaging Exposition, the machine is one of several built for Celanese Corp. of America for processing Lumarith film.

The new machine is designed for operation at speeds up to 800 feet a minute and has a rewind capacity of 15 inches in diameter. The unit is equipped with a variable-speed hydraulic main drive and a separate, but positively interlocked variable-speed rewind shaft drive. The rewind shaft speed varies inversely with the diameter of the rewound rolls, thereby avoiding overheating of the cores and consequent damage to the inner laps of the rewound rolls. An hydraulically controlled unwind stand eliminates friction brakes and automatically holds any desired tension on the web. Since the unwind stand has virtually no inertia, the hydraulic control responds to errors and corrects them instantaneously. Tension is variable over a range of 7.5:1 and may be changed at any time during operation.

Razor blade slitting permits strip widths as narrow as ½-inch. The differential rewind assures positive rewinding regardless of variations in the film gage. All gears, except the three rewind shaft pinions and their mating gears, are enclosed and run in oil. Other features include anti-friction bearings on idler and driven rolls; built-in precision alinement of parts; and massive frame and tie bar construction to dampen vibrations and provide durability.

Swedish Rubber Industry News

The Rubber Bureau in Sweden plans to organize International Latex Days in Stockholm, Sweden, as well as in Oslo, Norway, Copenhagen, Denmark, and Helsinki, Finland, in order to acquaint businessmen and industrialists in the above countries with the numerous possibilities for latex in modern industry.

Official statistics of Sweden's rubber industry show a reduction of more than 35% in imports of crude rubber by Sweden in 1950 as compared with 1949; the respective amounts were 14,510 tons, value 40,648,000 kronor, against 22,251 tons, valued 35,354,000 kronor. Imports of manufactured goods show a similar decrease in the case of tires and accessories for motor vehicles, from 3,849 to 2,156 tons. Imports of packing declined from 387 to 339 tons, but those of hose rose from 629 to 704 tons; belting, from 533 to 758 tons; and surgical goods, from 120 to 192 tons. With the exception of tires, the trend at the end of 1950 seems to have been toward increasing foreign purchases of manufactured rubber.

The drop in tire imports is accompanied by an increase in exports of these articles from 88 tons in 1949 to 728 tons in 1950. The only other important rubber manufactures exported were footwear and rubber-soled shoes; the former showed a decrease from 184 to 178 tons; the latter rose from 21 to 51 tons.

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An easy processing zinc oxide. Uniform particle size and absence of extreme "fines" assures good dispersion in rubber.

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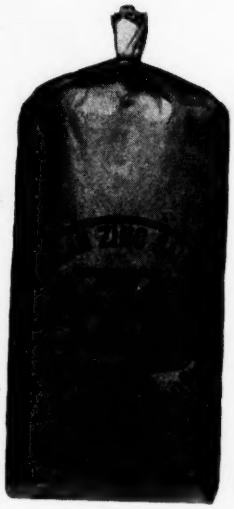

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Take advantage of our trial run offer and convince yourselves.

Send us 50 or 100 yards of liner material. We will treat it without charge and return for testing in your plant.

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Properties of Vulkollans

The highly elastic substances, Vulkollans,[1] have been discussed by O. Bayer and collaborators.[2] These materials are products of a diisocyanate polyaddition process based on the reaction of diisocyanates with di- or polyoxycompounds. The reaction can be carried out not only with oxy compounds, but also with substances which contain reactive hydrogen atoms. Linear polymers result when the diisocyanate is reacted with glycols, and compounds with reticular structure are obtained if compounds with three OH groups are employed instead. Highly elastic plastics are produced if polyesters of dibasic acids and polyvalent oxy compounds are also reacted with a diisocyanate. The greater the amount of aliphatic compounds, the more flexible is the final product. On the other hand, the use of aromatic ingredients results in harder and more brittle materials.

Even without the use of fillers or softeners, strong and very elastic products can be prepared; in fact it is pointed out that the latter rather tend to harden the material. But the addition of reinforcing fillers further improves the already remarkable tear resistance of these plastics, it is also claimed.

The Vulkollans are generally processed from solutions in acetone, benzol, and the like; hence they can also be used to cast films, as adhesives, and for dripping and spreading. In the absence of moisture these solutions are said to keep fairly well. The dipped or cast films lose the solvent portion, after which the netting reaction slowly sets in; catalysts, as pyridine, may be used to accelerate the reaction, which is not appropriate for any but thin films, as thicker bodies become spongy.

The properties of the Vulkollans vary with the starting materials; some unloaded mixes are said to show tensile strength values better than those of natural rubber and far above those of Buna; similar results are claimed in some cases for loaded mixes. The elasticity is comparable to that of Buna; aging and resistance to ozone and organic solvents are good; but resistance to alkalis and acids is poor; abrasion is better than that of the best rubbers. Like natural rubber, Vulkollans crystallize and show X-ray interferences, which, however, are very variable, depending on the composition of the materials.

[1] See India RUBBER WORLD, July, 1947, p. 516.
[2] *Angew. Chem.*, 62, 57 (1950).

Machines for the Rubber Industry

At recent exhibitions of machinery and appliances, some machines for use in the rubber and allied industries were also seen. A new machine for butt-joining unvulcanized extruded inner tubes has been devised by Maschinenfabrik Leonh. Herbert, Frankfurt a.m. The ends of the tube to be joined are held by two sprung compression jaws, and manipulation of a hand-lever brings down on them a double-edged cutter that is electrically heated to the desired temperature and controlled by a thermostat. After the knife is lifted again, pressure on a pedal causes the mounted ends with their freshly cut surfaces to be moved toward each other along a guide until they hit at the same time and are firmly pressed together. It is claimed that tubes joined in this way show no contraction whatever after vulcanization and have no unbalance.

A. Mannesmann Werke has put on the market its Ultra-Emulsor for the preparation of all kinds of emulsions, colloid solutions, suspensions, and dispersions, for homogenizing and mixing liquids and solutions of different consistencies, and for grinding pasty and liquid substances as finely as possible and free from grain. The material to be treated is introduced into the actual operating area by turbine action and is subjected to pressure differences and vibrations of more than 100,000 hertz, that is well into the supersonic region, and at the same time to mixing by whirling action and an increasingly close grinding process. The machine is built with great precision in all its parts, it is claimed, and is said to be resistant to wear and can easily be taken apart and quickly cleaned. Depending on the consistency of the materials and the effect desired, output ranges from 200 to 1,000 liters, per hour, with 10 h.p.

The same firm makes a hammer-cutting mill that automatically

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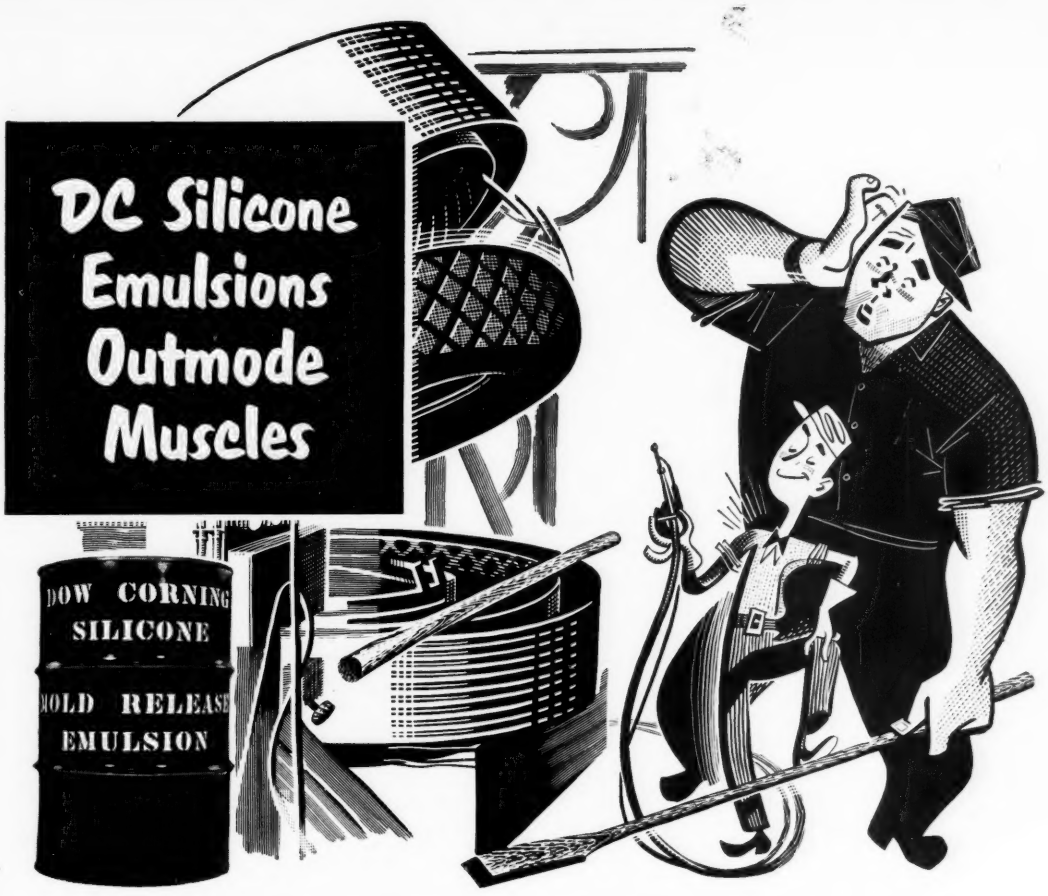

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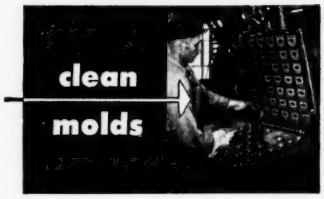

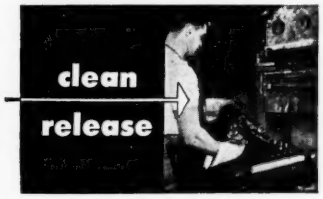

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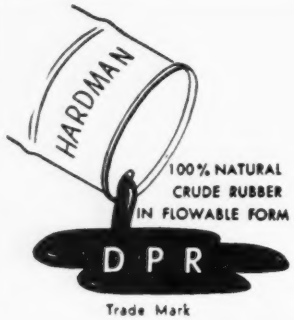

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GREAT BRITAIN

Reports from the IRI

The Sixth Foundation Lecture of the Institution of the Rubber Industry was given by S. S. Pickles in Manchester, on May 4. His topic was "The Chemical Constitution of the Rubber Molecule."

The Midland Section of the Institution of the Rubber Industry held a well-attended symposium on new testing techniques in Birmingham on March 12. The papers read included: "The Application of Ultrasonics to Rubber Testing," by P. Hatfield; "The Roelig Machine for the Dynamic Testing of Rubber," A. J. Aston; "The Application of Radio-Active Materials to Rubber Problems," J. Willmont; "Some Applications of Infrared Spectroscopy," by W. H. T. Davison.

At a meeting of the IRI council held in London, April 24, M. Fordyce Jones was elected Honorary Fellow of the Institution in recognition of his outstanding services to the Industry. Mr. Fordyce Jones, who until recently was chairman of Reliance Rubber Co, Ltd., is the fourth person to be so honored.

On the same occasion J. M. Buist and T. A. Werkenthin were elected Fellows of the Institution.

Mr. Buist, the author of many papers and joint patentee of several patents, has since 1943 been senior physicist in the rubber department of Imperial Chemical Industries, Ltd.

Mr. Werkenthin since 1944 has been principal materials engineer, civilian, in charge of the rubber branch, Bureau of Ships, Navy Department, Washington, D.C., U.S.A. The founder and past president of the Washington Rubber Group, Mr. Werkenthin has numerous patents and important technical publications to his credit.

Rubber Trade Notes

After the general annual meeting of Greengate & Irwell Rubber Co., Ltd., held April 11, the chairman, M. F. Frankenburg, paid tribute to the services rendered by the deputy chairman, Wm. Griffin Morris, during the past 50 years. On behalf of the directors, staff, and employes, Mr. Frankenburg presented to Mr. Morris his portrait in oils by Harold Knight, R.A., together with an illuminated volume containing expressions of esteem, affection, and gratitude.

The British Tire & Rubber Co., Ltd., reports group net profit for the business year ending September 30, 1950, at £621,-144 against £423,483 in the preceding fiscal year. This figure has been arrived at after providing for taxation (£600,655, against £434,217) and for exchange loss on Argentine current assets and deferred repairs. Total dividends for the year came to 25%, less tax, as compared with 20% for each of the preceding three years.

At a meeting on February 22 at *The India Rubber Journal* in London, it was decided to launch the "Rubber Veterans Club" which will have for its objects encouragement of fellowship and pride of craft, recognition of long service, and the development on a national scale of a trade benevolent fund. A provisional committee was appointed with Fordyce Jones, chairman; S. A. Parr, vice chairman; F. T. Brandon, editor of *India Rubber Journal*, honorary secretary; Derek Copeman, honorary treasurer.

Thomas De La Rue & Co. has taken over the assets and liabilities of the wholly owned subsidiary company, De La Rue Extrusions, which has been placed in voluntary liquidation. This step has been taken in order to facilitate operation of the industrial group. The continuity of the business of De La Rue Extrusions will not be affected; it will operate under the plastics division of Thomas De La Rue & Co.

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Geoffrey Gee, director of research of the British Rubber Producers' Research Association, is one of 25 newly elected Fellows of the Royal Society. Dr. Gee in 1931 joined the I.C.I. Dyestuffs Group, but in 1938 resigned to act as the first senior physical chemist of the newly formed BRPRA. He was appointed to his present position in 1947. Dr. Gee is known for his work in connection with the thermodynamics of polymer-liquid systems and the mechanical properties and mechanical structure of polymer molecules. He has also taken out patents on the production of rubber hydrochloride.

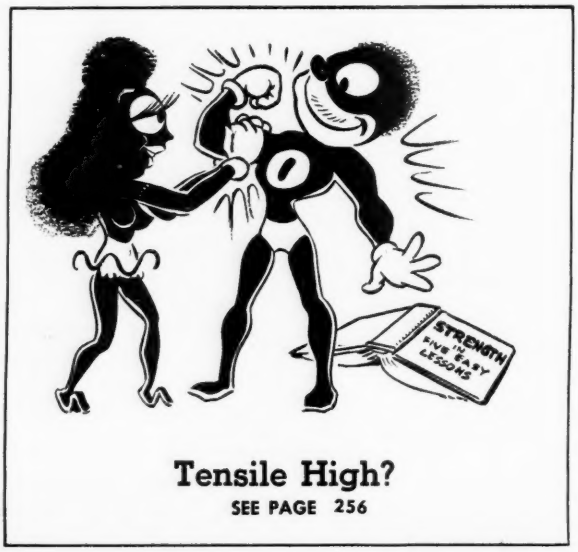
On March 31, W. J. S. Naunton retired as director of the Rubber Service Laboratories of Imperial Chemical Industries, Ltd. As a token of appreciation of his long services, his co-workers presented him with a handsome desk. Dr. Naunton started the first I.C.I. rubber laboratories toward the close of World War I and was responsible for the production of accelerators and antioxidants. He has written numerous papers and taken out more than 100 patents. He now plans to do a limited amount of advisory and consultation work while keeping in touch with research developments and maintaining his interest in the Institution of the Rubber Industry, whose chairman of council he is.

At a meeting of the Plastics & Polymer Group, Society of Chemical Industry, arranged for April 17, E. M. Evans, of British Resin Products, Ltd., was scheduled to present a paper on "Cashew Nut Shell Liquid and Its Applications."

BELGIUM

In collaboration with the National Institute of Commerce, Belgium, the Brussels office of the Rubber Foundation of Delft, Holland, now known as the International Rubber Bureau, Belgian Section, organized a special rubber exhibition held in Antwerp from March 30 to April 14. To mark the occasion, the Rubber Foundation published a special issue of its organ, *Rubber*, to which leading Belgian personalities contributed articles on their country's advances in rubber production and rubber manufacture.

We are reminded that Belgium's rubber manufacturing industry was begun around 1890 and now includes some 115 enterprises of all sizes, from the largest employing 2,000 persons to tiny one-man or family affairs. Altogether about 7,000 workers are engaged in producing a very wide variety of goods which require about 16,000 tons of natural rubber annually. In recent years an increasing amount of synthetic rubber, amounting in 1950 to roughly 800 metric tons, has been imported from the United States and Canada. Most of the fillers and pigments are produced locally, but for sulfur, carbon black, and many other materials, the country still depends largely on the United States. In the first nine months of 1949, about 4,800 tons of all kinds of rubber goods, valued at some 257,000,000 Belgian francs, were exported, chiefly to Holland, France, Belgian Congo, Sweden, Switzerland, and Italy.



Tensile High?

SEE PAGE 256

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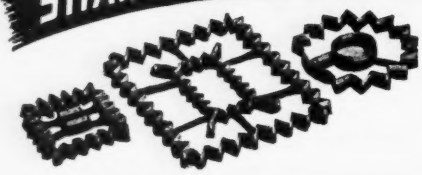

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One of the leading rubber manufacturers here is Bergougnan Belge, which has modern factories and research laboratories and produces a wide variety of goods, including tires and tubes for motor vehicles and cycles, hose for numerous purposes, conveyer belting (since 1930), transmission belting, latex foam mattresses and upholstery (since 1935). Several other firms are also utilizing latex in their manufactures; one of the earliest in the field in Belgium was Etablissements L. de Bruyn, whose specialties are nipples, balloons, gloves, etc.; Cuirub of Courtois makes latex foam goods; Societe Carideng uses the latex cold-flow process for producing toys; Etablissements Moreels of Malines makes soles and heels from latex by a new process; latex thread is a specialty of Courroiries du Mont-Saint-Amand, which also utilizes latex-treated cotton for belting.

In a different field, we have the Belgium branch of Manufacture P. Lacollonge, Lyon, France, which was established at Zuen-lez-Bruxelles in 1932 to produce rubber and later, plastic, chemically resistant linings for tanks, containers, and pipings. In 1945 the Belgian firm permitted N. V. de Plaatwellerij, Velsen-Noord, Holland, to exploit its patents for rubber linings.

SWITZERLAND

An international latex day was scheduled for Zurich, April 4. Among the papers listed were: "The Advantages of the Industrial Application of Latex" and "The Economic Possibilities of the Use of Latex," by R. Houwink, general director of the Rubber Foundation, Delft, Holland; "The Economic Position of the Latex Market in the World" and "The Advantages of Incorporating Latex in Road Surfacing Materials," B. Godfrey, director of the applications section of the French Rubber Institute, Paris, France; "Latex Types on the Market" and "Ebonite from Latex; Production and Preparation," G. M. Kraay, Rubber Foundation; "Production of Foam Rubber," J. van Houweninge, director of the application section of the Rubber Foundation; "Manufacture of Molded Goods from Latex," F. Lepetit, French Rubber Institute. "The Effect of Fillers in Latex," G. Giger, French Rubber Institute.

FRANCE

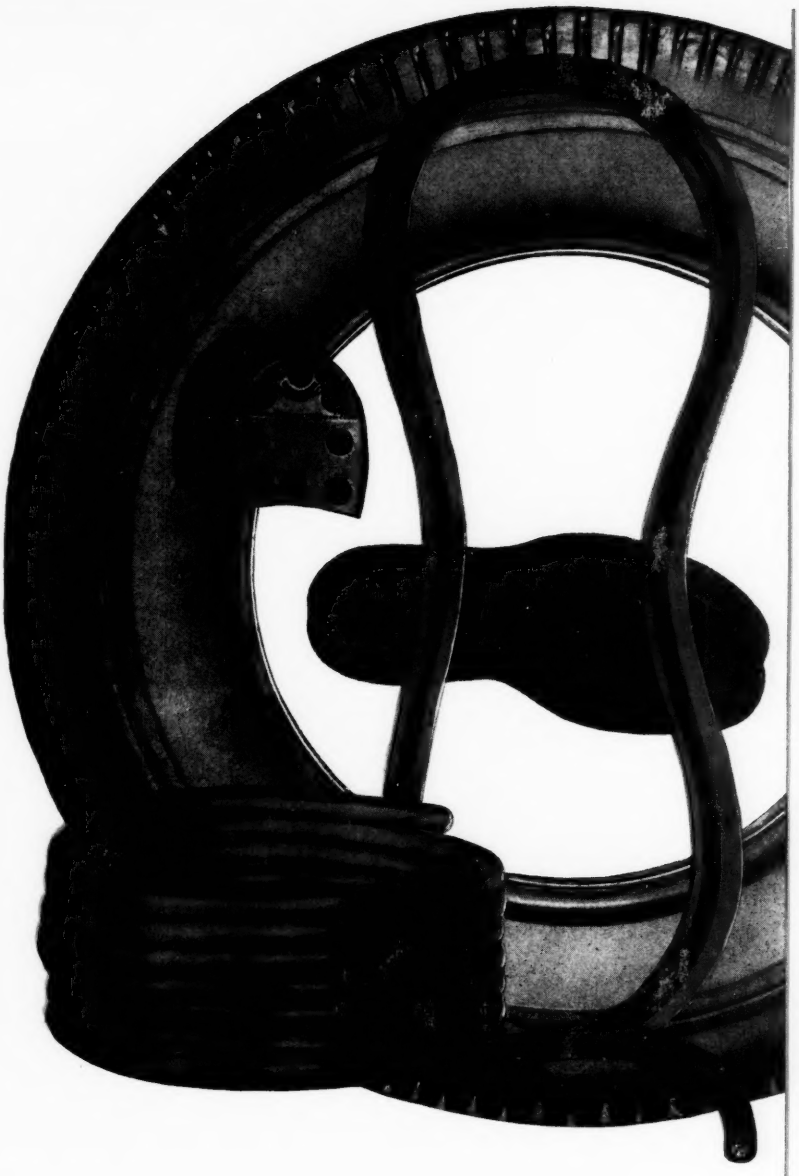
At the request of the French Ministry of Industry & Commerce, the chemical and petroleum industry has been studying the possipility of producing synthetic rubber here. According to recent reports, it was found that the country could produce 30,000 to 40,000 tons of synthetic rubber annually, from raw materials normally available; furthermore, it would be possible to start such production by 1954; that the most economical process for France would be one utilizing petroleum refinery gas; and finally that it would require 35,000 to 40,000 million francs to set up a synthetic rubber industry.

NORWAY

A report on the position in 1950 of Norway's planned plastics industry reveals that much progress was made during the year. Factories to produce formaldehyde, phenolic resins, and phenol formaldehyde and urea formaldehyde molding powders were completed; construction of polyvinyl chloride and urea plants was undertaken; production of Monoplast, a thermosetting plastic derived from fish waste, could be increased, and the quality improved. The Norwegian Plastics Federation was also organized in the course of the year.

RUMANIA

Under the new five-year plan, to run from 1951-1955, the target for the Rumanian chemical industry is an increase of 164% by 1955 as compared with the 1950 level. The manufacture of rubber goods comes under chemical industry. Under the terms of the plan, the goal for 1955 includes the output of 4,000 tons of rubber tires.



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ALDEHYDE AMINE ACCELERATORS

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A-77*
A-100

MERCAPTO ACCELERATORS

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El-Sixty*
Ureka* C
Ureka Base
Mertax (Purified Thiotax)
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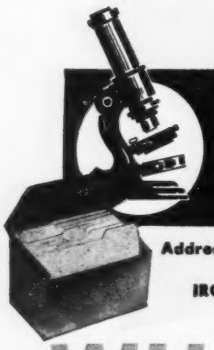

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Editor's Book Table

BOOK REVIEWS

"Plasticizers." D. F. Buttrey. Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y. Cloth 5½ by 8½ inches, 183 pages. Price, $4.25.

This volume is essentially a working handbook on plasticizers that have either already found commercial application or appear to have future importance in the plastics industry. Information appears on some 400 plasticizers, grouped in chemical classes. For each plasticizer are given its composition, properties, advantages and disadvantages, and a bibliography of references. Plasticizer-type classifications used include phthalate esters, phosphoric acid derivatives, glycerol and glycol derivatives and esters, esters of adipic and sebacic acids, fatty acid esters, abietic and ricinoleic acid esters, toluene sulfonic acid derivatives, diphenyl derivatives, miscellaneous types (including camphor, anilides, urea derivatives, substituted phenols, etc.), and hydrocarbon and aromatic extenders. The final chapter presents a brief survey of theoretical aspects of plasticizers and is intended for those not already in the field. A general bibliography, list of tables, and author and subject indices are appended. The value of this work as a source of practical and convenient data on plasticizers is self-evident.

"Physico-Chimie du Latex." W. Kopaczewski. Dunod, 92 Rue Bonaparte (VI), Paris, France. 1951. Paper, 6½ by 10 inches, 169 pages.

No systematic research work has yet been carried out on the colloidal equilibrium of latex, and hardly anything is known about the mechanism of the physical or chemical factors capable of disturbing this equilibrium, the author points out in his foreword. For eight years he has studied various latices, more particularly that of *Euphorbia resinifera*, to determine their physico-chemical characteristics, and results have been compared with existing "fragmentary" knowledge and collected in this monograph which the author claims is the first attempt at a physico-chemistry of latex. The book also includes hitherto unpublished personal researches.

It is divided into three parts discussing, respectively, generalities, conditions of stability, and analogies. The first part has two chapters. The first briefly discusses the latex-bearing individuals of no fewer than 20 families of plants; while the second chapter takes up the physical and colloidal characteristics of latex.

Of the three chapters in part two, the first treats of the phenomena of gelling and gels (the author includes coagulation and coagula) and the physical, mechanical, and chemical agents used in gelling; the second chapter deals with the phenomena, experimental conditions and mechanism of disjunction (separation into phases or fractions); the third chapter covers stabilization.

In part three, plastomers and elastomers are treated, and finally simple and complex biocolloids. An extensive bibliography concludes the work, which, however, contains no reference notes nor indices.

NEW PUBLICATIONS

"The Aquarexes, Surface Active Agents for Use in Latex Processes and as Mold and Stock Lubricants." Report No. 51-2, March, 1951. E. P. Hartsfield and J. C. Fitch. E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 14 pages. This report gives detailed information on the properties of the six Aquarex materials and their use as stabilizing and wetting agents in latex and as processing aids in dry elastomers.

"Industrial Dust Control through Exhaust Systems." V. O. Vedder. Pangborn Corp., Hagerstown, Md. 54 pages. Intended to acquaint plant executives with means of controlling industrial dusts by exhaust systems, this illustrated booklet discusses basic methods and advantages of dust control and gives detailed information on the component parts of an exhaust system, including exhaust hoods and piping systems, dust collecting equipment, and exhausters and drives.

"Wyandotte Purecal in GR-S." Wyandotte Chemicals Corp., Wyandotte, Mich. 56 pages. This comprehensive and illustrated booklet gives complete information on the Purecal ultra-fine calcium carbonates and their use in GR-S compounds. Discussions and data are presented on loadings with and without organic reinforcers; comparisons with other non-black compounding ingredients; effect of loading materials on the physical properties of GR-S stocks containing Purecal; savings in pigments obtained by use of Purecal loadings; use of Purecals in low temperature GR-S; and typical formulations for various types of GR-S stocks containing Purecal.

"Recommended Commercial Standard for Latex Foam Mattresses for Hospitals." Publication TS-5066. Commodity Standards Division, Office of Industry & Commerce, United States Department of Commerce, Washington 25, D. C. 8 pages. Prepared by The Rubber Manufacturers Association, Inc., and approved by the American Hospital Association, this recommended standard is being circulated to producers, distributers, and users for acceptance. The standard covers minimum requirements and methods of testing for one grade of latex foam mattress made of either natural or synthetic rubber latex.

"Annual Report on the Progress of Rubber Technology. Vol. XIII, 1949." Edited by T. J. Drakeley. Institution of the Rubber Industry, Ltd., 12 Whitehall St., London S.W.1, England. Paper, 108 pages. Price: members, 4/6; non-members, 12/6. This report on progress during 1949 contains the following summary articles: "Historical and Statistical Review," C. F. Redfern and M. J. Mackie; "Planting and Production of Raw Rubber and Latex, Including Gutta Percha, Balata, Chicle, and Jelutong," W. G. Wren; "Physics and Chemistry of Raw Rubber and Rubber Derivatives, Gutta Percha, Balata, Chicle, and Jelutong," C. M. Blow; "Synthetic Rubber," H. T. Messenger and R. W. Parris; "Compounding Ingredients," J. H. Haworth; "Fibers and Fabrics," J. W. Illingworth; "Physical and Chemical Properties of Vulcanized Rubber," L. Mullins; "Tires," E. R. Thornley; "Belting," N. G. Hiscox; "Hose and Tubing," J. W. Denson; "Cables and Electrical Insulation," W. R. Pryer; "Mechanical Rubber Goods," S. Buchan; "Games, Sports Accessories, Toys, Etc.," S. G. Ball; "Surgical Goods," W. H. Reece; "Textile-Rubber Composites, Solvents, and Cements," F. T. Bowden; "Cellular Rubber," W. D. Guppy; "Machinery and Appliances," Joseph Brown; "Hard Rubber," B. L. Davies; and "Flooring," W. H. Reece. Both author and subject indices are appended.

"Stretching Highway Dollars with Rubber Roads." Harry K. Fisher. Natural Rubber Bureau, 1631 K St. N.W., Washington 6, D. C. 38 pages. This new 1951 edition of the booklet describes all facts, experiences, and conclusions developed to date on the use of rubber in roads. Test strips laid in this country and abroad are described in detail, but it is pointed out that the full extent of the benefits to be derived from rubber roads have yet to be determined by study of test sections now in place and additional sections being planned.

Publications of the British Rubber Producers' Research Association, 48 Tewin Rd., Welwyn Garden City, Herts., England. No. 134. **"Mastication and Compounding of Natural Rubber in an Oxygen-Free Atmosphere."** C. M. Blow and R. I. Wood. 19 pages. The first part of this paper deals with the relative effects of masticating natural rubber in air and in nitrogen over a temperature range from 50-140° C., with a survey of the effects of common plasticizers. The second portion covers the production of a number of pure gum compounds under nitrogen and compares the properties of vulcanizates with those obtained from corresponding air compounded vulcanizates.

No. 135. **"Latex Molding by Plaster Casting."** S. C. Stokes. 5 pages. Methods for producing cast figures from latex include the use of porous molds, such as plaster, and the use of metal molds with heat sensitized latex. Mention is also made of the use of rubber molds for casting plaster figures.

No. 136. **"The Nature of the Sulfur-Oxygen Bond."** W. Moffitt. 20 pages. The electronic structures of certain molecules containing oxy-sulfur bonds are analyzed in some detail by means of the molecular orbital method, and a successful correlation may be set up between the molecular orbital criterion of bond strengths and the oxy-sulfur bond force constants.

No. 137. **"Some Problems Involved in the Grading and Testing of Natural Rubber."** W. P. Fletcher. 10 pages. This paper is a progress report on work being done to improve natural rubber quality, including cleanliness, processibility of unvulcanized materials, and properties of vulcanizates.

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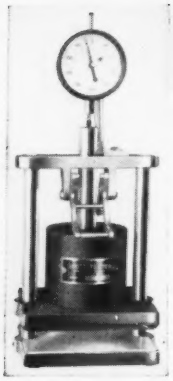

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No. 138. **"Kinetic Studies in the Chemistry of Rubber and Related Materials. VIII.** Influence of Chemical Structure on the Alpha-Methylenic Reactivity of Olefins." J. L. Bolland. 11 pages. The efficiency of the radical reaction representing the exchange of a hydrogen atom between the alpha group of an olfin RH and a peroxide radical RO_2– has been determined for a series of 24 unsaturated hydrocarbons, and the influence of certain structural features of olefinic groupings in determining the ease of alpha-methylenic hydrocarbon abstraction identified.

No. 139. **"Term Values in Hybrid States Aspects of Hybridization."** W. Moffitt. 31 pages. Several calculations are given which are considered necessary to a proper understanding of the factors governing orbital hybridization. A classification system is introduced for the different types of hybridization which arise for elements of the first short period, and a general method appears for calculating the term values of the hybrid valence states associated with such atoms.

No. 140. **"An Analysis of the Isomeric Composition of Bromodihydromyrcene. Dehydrobromination Experiments with Bromodihydromyrcene."** L. Bateman, J. I. Cunneen, and H. P. Koch. 13 pages. In the first paper the allylic bromide produced by reacting dihydromyrcene with *n*-bromosuccinimide is approximately analyzed largely by infrared spectroscopic means and is found to conform to certain theoretical predictions. In the second paper, possible mechanisms are discussed for the fact that the elimination of hydrogen bromide from the heterogeneous dihydromyrcene bromide gives only small yields of the conjugated triene *allo*ocimene; while the major products are open-chain trienes containing conjugated diene units and cyclic conjugated dienes.

"Chemigum Rubbers." Goodyear Tire & Rubber Co., Inc., Akron 16, O. 32 pages. This bulletin offers extensive information on the types, properties, compounding, and applications of the Chemigum rubbers. The data on applications include formulations and test data on many typical compounds, including hose interliners, shoe soles, packings, belt covers, friction stocks, adhesives, and others. Appendices include Banbury and mill mixing Mooney breakdown charts, accelerated aging tables, chemical resistance tables, etc.

"Lighting and the Nation's Welfare." National Information Committee on Lighting, 1410 Terminal Tower, Cleveland, O. 24 pages. **"One Week for America."** B. F. Goodrich Co., Akron, O. 12 pages. **"Inorganic Production Chart."** Wyandotte Chemicals Corp., Wyandotte, Mich. 1 page. **"Survival Qualities of American Business."** Dun & Bradstreet, Inc., 290 Broadway, New York, N. Y. 16 pages. Publications of American Management Association, 330 W. 42nd St., New York 18, N. Y. Personnel Series No 138. **"Critical Factors in Management Planning."** 32 pages. No. 139. **"Manpower Resources for the Emergency."** 44 pages.

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MARKET REVIEWS

CRUDE RUBBER

SHARP declines in natural rubber prices at the Singapore and the London markets took place early in May. Rubber was quoted at about 46¢ a pound, a decrease of some 20¢ from earlier levels, as market observers heralded the return of rubber prices to more realistic levels. While the recession was based on several factors, the decision of the British Government to cut off all rubber exports to China and Russia provided the final impetus to the price break. Although Indonesia announced that it will continue to sell rubber to the Communist countries in exchange for needed goods, this effect on the market will be more than overbalanced by the British announcement and the workings of the United States Government buying program.

This government buying program has eliminated competition between large domestic consumers in the primary markets, with the result that GSA has been able to choose the market and price at which to buy rubber. GSA was reported to have purchased large quantities of crude rubber late in April and early in May, while lowering its purchase price each time. In its current bought-up position, observers believe that GSA could well afford to pull out of the primary markets completely for some time and thereby pull the floor out from under the natural rubber price picture.

The OPS is said to be pressing for a reduction of about 50% in the GSA selling price of rubber to domestic consumers. GSA is protesting that such a scheme could not be put into effect under existing law or, at least, without an overriding policy directive from the White House. GSA is expected to lower its selling price in June or July in accordance with the recent drop in the primary markets, but objects to an overall price cut until losses sustained in the beginning of this year are made up.

Latices

WHILE March consumption of *Hevea* latex was in excess of 5,500 tons, April consumption is expected to be lower because of uncertain allocations and a slump in some product lines, according to Arthur Nolan, Latex & Rubber, Inc., writing in the May issue of *Natural Rubber News*. It is apparent that the 84.5¢ per pound GSA selling price has eliminated *Hevea* latex from many applications, and it is uncertain whether the foam industry can maintain the recent high consumption level through further growth.

It is believed that the NPA Rubber Division is up to date in the processing of requests for adjustments and exceptions from the latex regulations of M-2, since most of the backlog of requests was handled during April. In this connection, both Mr. Nolan and Robert A. Lees, American Anode, Inc., have joined the staff of the Rubber Division to work on latex matters.

Demand for GR-S latex is far in excess of supply, although production has increased over the 1950 level. The increase in GR-S latex production has not kept pace with the expansion in dry rubber production because of stockpile needs for dry GR-S, and the fact that certain types of latex require more styrene and longer reactor times than most solid polymers. Low temperature polymerized GR-S latices are in especially strong demand, particularly by the tire and foam industries. While present supplies are very limited, greater quantities will be produced as facilities become available.

February imports of *Hevea* latex totaled 5,347 long tons, dry weight; consumption was 5,275 long tons; and month-end stocks, 5,936 long tons. Estimates for March are: imports, 7,402 long tons; consumption, 5,519 long tons; and month-end stocks, 7,290 long tons. GR-S latex production figures are as follows: March, 2,687 long tons, dry weight; April, 2,500 long tons (estimated); and May, 2,500 long tons (estimated). Bulk GR-S latex prices continue unchanged at 24.5-26.25¢ per pound, plus freight charge.

RECLAIMED RUBBER

NO CHANGE occurred in the reclaimed rubber market picture during the period from April 16 to May 15. Production and sales of reclaim continued at high levels, and the industry awaited the issuance of ceiling price regulations, reported drawn up and ready.

Final January and preliminary February statistics on the domestic reclaimed rubber industry are now available. Final January figures give a production of 32,924 long tons; imports, 120 long tons; consumption, 32,455 long tons; exports, 1,336 long tons; and month-end stocks, 35,843 long tons. Preliminary figures for February show a production of 30,337 long tons; consumption, 28,026 long tons; exports, 1,629 long tons; and month-end stocks, 37,260 long tons.

No changes were made in reclaimed rubber prices during the period, and current quotations follow:

Reclaimed Rubber Prices

	Sp. Gr.	¢ per Lb.
Whole tire	1.18-1.20	10.00/10.75
Peel	1.18-1.20	nom.
Inner tube		
Black	1.20-1.22	nom.
Red	1.20-1.22	nom.
GR-S	1.18-1.20	nom.
Butyl	1.16-1.18	nom.

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

SCRAP RUBBER

AFTER some months at unchanging levels, scrap rubber prices showed an upward movement during the period from April 16 to May 15. Most of the price increases took place during the latter part of April as the result of continuing strong demand for tires, peelings, and tubes. Incidentally, dealers pointed out that these price advances were in line with the general price freeze order since they did not exceed prices paid during the base period of December 19 to January 26. In the beginning of May, however, a lessening in demand for scrap rubber made itself felt as some reclaimers reduced their orders. Certain reclaimers are reported to be fairly well stocked up with sufficient scrap to cover requirements for the immediate future, but others continued buying actively in the scrap market. Export business is reported inactive, although numerous inquiries are being received.

In general, the scrap rubber industry marked time while waiting for the issuance of dollars and cents ceiling prices by OPS. Reports from Washington indicate that the scrap rubber price order has been prepared and signed and should be issued shortly. Trade observers believe that the price ceilings will probably be somewhere in the neighborhood of current market quotations, but there is some question as to whether the ceilings will be on an f.o.b. or on a delivered price basis.

Following are dealers' selling prices for scrap rubber, in carload lots, delivered to mills at the points indicated:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$33.00	$34.00
Peelings, No. 1	70.00	70.00
3	40.00	40.00
	(¢ per Lb.)	
Black inner tubes	13.00	13.00
Red passenger tubes	20.00	20.00

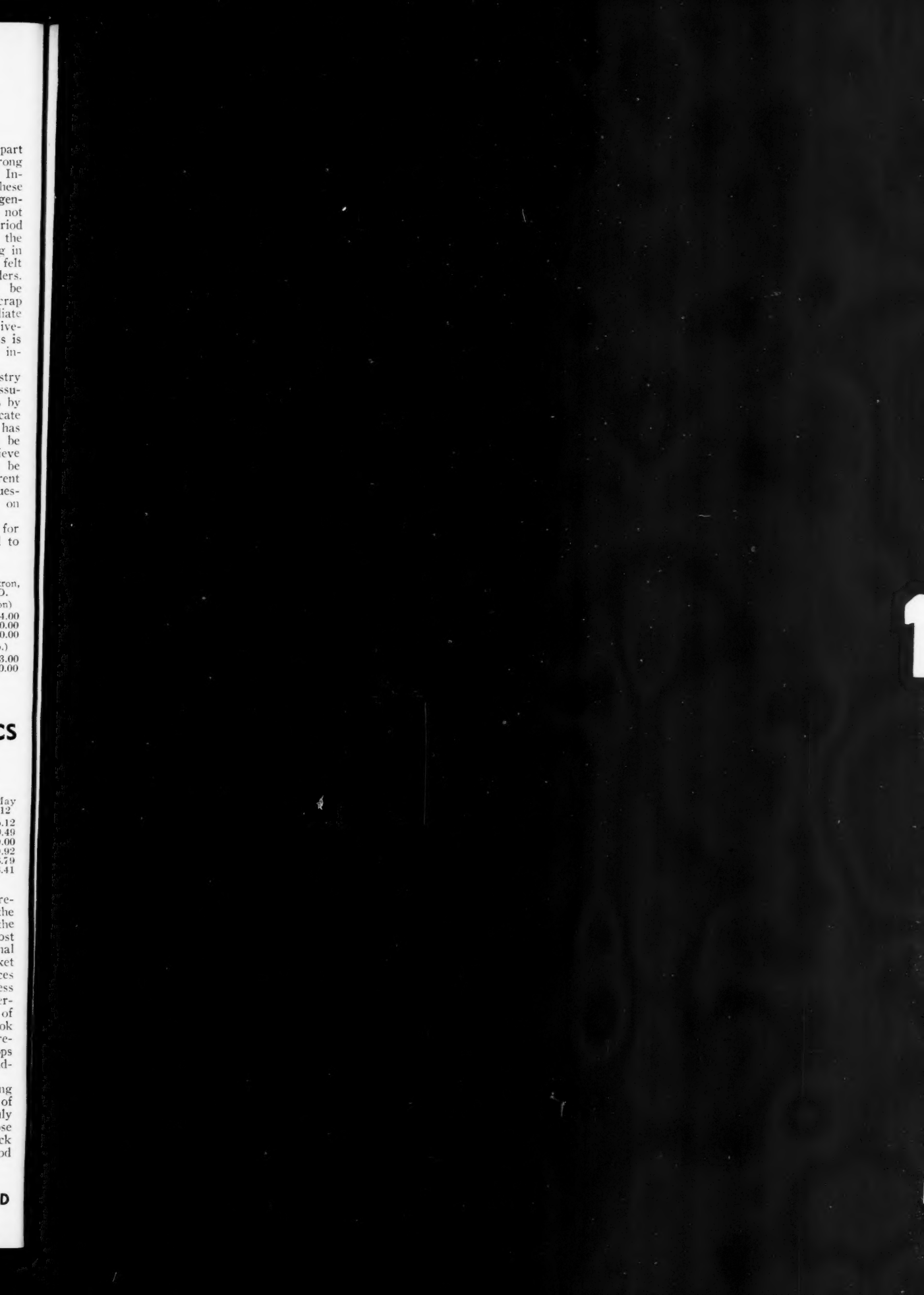
COTTON AND FABRICS

NEW YORK COTTON EXCHANGE
WEEK-END CLOSING PRICES

Futures	Jan. 27	Mar. 31	Apr. 21	Apr. 28	May 5	May 12
July	43.31	44.94	45.11	45.26	44.98	45.12
Oct.	41.36	40.65	39.76	40.16	39.39	39.49
Dec.	40.96	40.09	39.22	39.69	38.79	39.00
Mar.	49.86	39.90	39.13	39.58	38.69	39.92
May	40.67	39.66	38.92	39.22	38.51	38.79
July	40.40	39.26	38.52	38.97	38.15	38.41

CONTINUING the trend of the previous month, trading was light on the New York Cotton Exchange during the period from April 16 to May 15. Most activity was of a local or professional nature, and there were no sustained market movements. The general trend of prices was upward in view of continued tightness in old crop cotton, a general steady undertone in the market, and the absence of speculative trading. Some declines took place early in May owing to renewed predictions of a large crop, but these drops were later cancelled out by further advances in the new crop months.

The spot price for 15/16-inch middling cotton remained at the ceiling level of 46.06¢ per pound during the period. July futures started at 44.77¢ on April 16, rose to a high of 45.27¢ on April 27, fell back to 44.93¢ on May 7, and closed the period at 45.11¢.



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Fabrics

The industrial fabrics market was relatively quiet throughout the period, with most trading confined to second-hand materials. In sheetings, moderate quantities were sold into the fourth quarter; while some sales in sateens were reported for the third quarter. In general, prices held firm despite lagging sales as the market awaited the issuance of the textile price order by the Office of Price Stabilization.

Prices of osnaburgs have remained relatively firm in recent weeks in view of a tight supply situation expected to persist for some months. Most mills were sold up through the second quarter and waiting for ceiling prices to be established before booking any business for the third quarter.

Cotton Fabrics

Drills			
59-inch 1.85-yd.	yd.	$0.49	/ $0.50⅛
2.25-yd.		.42	/ .42⅞
Ducks			
38-inch 1.78-yd. S. F.	yd.	.48⅞	/ .50⅝
2.00-yd. D. F.	yd.	.445	/ .46
51.5-inch, 1.35-yd. S. F.		.645	/ .66⅝
Hose and belting		.82	
Osnaburgs			
40-inch 2.11 yd.	yd.	.40	
3.65-yd.	yd.	.24	
Raincoat Fabrics			
Bombazine, 64x60 5.35-yd yd.	nom.		
Print cloth, 38½-inch, 64x60		.17	/ .19
Sheeting, 48-inch, 4.17 yd.		.26⅞	/ .27⅝
52-inch 3.85-yd.		.29⅛	/ .29⅝
Chafer Fabrics			
14-oz./sq. yd. Pl	lb.	.84	/ .865
11.65-oz./sq. yd. S.		.78	/ .80
10.80-oz./sq. yd. S.		.8175	/ .84
8.9-oz./sq. yd. S.		.83	/ .855
Other Fabrics			
Headlining, 58-inch 1.35-yd., 2-ply	yd.	.62	
64-inch, 1.25-yd. 2-ply		.725	/ .74
Sateens, 53-inch 1.32-yd.		.71	/ .73
58-inch 1.21-yd.		.775	/ .79¼
Tire Cords			
K. P. std., 12-3-3	lb.	nom.	
12-4-2		.95	

RAYON

RAYON shipments by United States producers to domestic consumers totaled 109,100,000 pounds during April, a decrease of 3% from the March figure. Total shipments during the first four months of 1951 amounted to 426,700,000 pounds, an increase of 8% over the corresponding period last year. Shipments of viscose high-tenacity tire-type yarn reached 25,900,000 pounds in April and 104,800,000 pounds for the first third of 1951.

Production of viscose high-tenacity yarn during the first quarter of 1951 totaled 80,200,000 pounds. Shipments to the tire industry and related industries during this period amounted to 76,200,000 pounds, with an average denier of 1,568. The average denier of shipments for tires and related uses during the fourth quarter of 1950 was 1,561, and the current figures continue the trend toward larger denier yarns.

No changes occurred in rayon tire yarn and fabric prices during the period from April 16 to May 15, and current prices follow:

Rayon Prices

Tire Yarns

1100/480	$0.62/	0.63
1100/490		.62
1150/490		.62
1650/720	.61/	.62
1650/980		.61
1960/980		.61
2200/960		.61
2200/980		.60
4400/2934		.63

Tire Fabrics

1100/490/2	.72
1650/980/2	.695/.73
2200/980/2	.685

Financial

(*Continued from page 358*)

Lee Rubber & Tire Corp., Conshohocken, Pa., and subsidiary. Year ended October 31, 1950 (revised report): net income, $2,944,732, equal to $11.61 a capital share, contrasted with $1,211,499, or $4.78 a share, in the preceding fiscal year; federal income tax, $2,341,115, against $815,752; current assets, $20,132,679 against $16,808,044.

Monsanto Chemical Co., St. Louis, Mo., and subsidiaries, except British and Canadian ones. Quarter ended March 31: net profit, $6,213,739 equal to $1.25 each on $4,868,189 common shares, compared with $5,521,857, or $1.12 each on 4,389,717 shares, in the same period of 1950: net sales, $67,936,955, against $46,183,957; provision for income taxes, $7,947,266, against $4,524,819.

National Lead Co., New York, N. Y. Three months to March 31: net profit, $5,149,814, equal to $1.36 a share, compared with $4,771,298, or $1.30 a share, a year earlier; sales, $104,923,524, against $62,189,412.

Okonite Co., Passaic, N. J. Quarter ended March 31: net income, $406,594, equal to $2.96 a common share, against $76,057, or 55¢ a share, in the corresponding quarter of 1950.

O'Sullivan Rubber Corp., Winchester, Va. First quarter, 1951: net income, $89,911, equal to 21¢ a common share, against $39,000, or 8¢ a share, in the 1950 period.

Phillips Petroleum Co., Bartlesville, Okla., and subsidiaries. First quarter, 1951: net profit, $15,882,271, equal to $2.51 each on 6,323,088 shares, compared with $10,049,580, or $1.66 each on 6,049,700 shares, in the like period last year; provision for federal income taxes, $6,268,200, against $2,485,300.

Plymouth Rubber Co., Inc., Canton, Mass. Year ended Novebmer 30, 1950: net profit, $926,486, equal to $1.07 a common share, contrasted with $246,892, or 27¢ a share, in the preceding fiscal year; sales $14,653,280, against $11,236,934.

St. Joseph Lead Co., New York, N. Y., and subsidiaries. Three months to March 31: net income, $3,817,246, equal to $1.55 a share, against $2,010,984 or 81¢ a share, in last year's quarter; net sales, $29,612,141, against $20,259,697.

Pittsburgh Plate Glass Co., Pittsburgh, Pa. First three months, 1951: consolidated net income, $10,744,464, equal to $1.19 a common share, compared with $7,955,705, or 88¢ a share, in the corresponding period last year; sales, $103,795,145, against $69,785,926.

Raybestos-Manhattan, Inc., Passaic, N. J., and domestic subsidiaries. March quarter: net profit, $1,134,711, equal to $1.81 each on 628,100 capital shares, contrasted with $620,085, or 99¢ a share, in the like period last year; provision for federal income taxes, $2,391,200, against $483,000.

Shell Oil Co., New York, N. Y., and consolidated subsidiaries. First quarter, 1951: net income, $23,258,557, equal to $1.73 each on 13,470,625 capital shares, contrasted with $22,060,639, or $1.64 a share, in the 1950 quarter; provision for income taxes, $21,100,000, against $9,500,000.

Skelly Oil Co., Kansas City, Mo., and subsidiaries. First three months, 1951: net income, $7,260,980, equal to $2.77 each on 2,611,871 common shares, compared with $5,682,708, or $2.17 a share, a year earlier; provision for taxes $3,630,500, against $1,511,000.

Timken Roller Bearing Co., Canton, O. March quarter: net income, $4,806,542, equal to $1.99 a common share, against $3,059,563, or $1.26 a share, in the corresponding period last year.

Union Asbestos & Rubber Co., Chicago Ill. First three months, 1951: net profit, $154,016, equal to 32¢ each on 475,176 capital shares, compared with $8,815, or 2¢ a share a year earlier; net sales, $2,530,778, against $1,687,160; provision for income tax, $123,741, against $5,403.

United Carbon Co., Charleston, W. Va. First quarter, 1951: net income, $922,817, equal to $1.16 a common share, against $825,826, or $1.04 a share, in the like period last year.

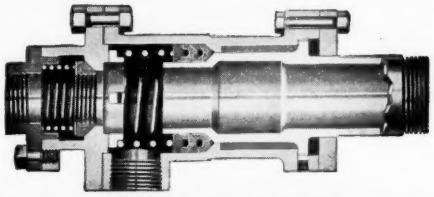
United States Rubber Co., New York, N. Y. January-March, 1951: net earnings, $9,076,755, equal to $4.41 a share, against $3,927,375, or $1.49 a share, in the corresponding months of 1950; consolidated net sales, $211,930,849, against $130,331,500; provision for income taxes, $23,289,241, against $3,032,549.

U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y. March quarter, 1951: net income, $126,298, against net loss of $9,480 in the 1950 period.

S. S. White Dental Mfg. Co., Philadelphia, Pa. Initial quarter, 1951: net profit, $350,558, equal to $1.00 a share, against $106,578, or 35¢ a share, in the 1950 period.

Whitney Blake Co., Hamden, Conn. For 1950: net income, $410,800, equal to $2.05 a share, against $44,160, or 22¢ a share, in 1949; net sales, $6,927,377, against $4,459,240.

"DIAMONDS" are leak-proof!



REVOLVING JOINTS (Illustrated)

—are made in a complete range of sizes from 1" to 2½" roll connections for use on rubber mills, mixers or any other steam heated or water cooled roll. Patented construction prevents leaking. Specially compounded molded gasket lasts 14 months on average in severe service—easy, quick and inexpensive to replace—no tight packing to act as brake on roll.

SWING and BALL JOINTS...

—for use on rubber and plastic molding presses. Especially constructed to offset expansion and contraction caused by sudden change from high pressure steam to cold water. Permanently ends leaking nuisance. Ball joints recommended to correct misalignment in any hook-up.

Bulletin and Prices upon request

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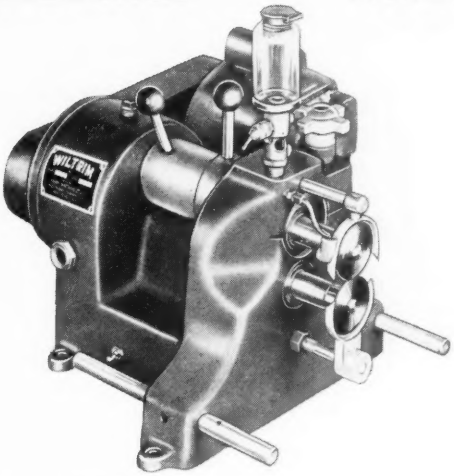
406 MARKET ST. ST. LOUIS 2, MO.

Majestic Import & Export Co., Sole Export Agents,
721 Olive St., St. Louis 1, Mo., Cable address "Hermpopper"

WILTRIM

Model DF TRIMMER



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FERRY MACHINE COMPANY

WILLS RUBBER TRIMMING DIVISION

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FOR RED RUBBER

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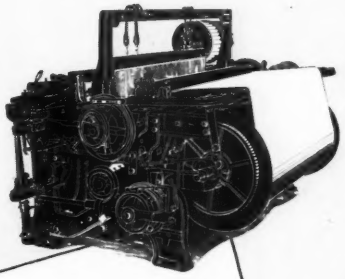

High quality cotton ducks and industrial fabrics—produced under rigid laboratory controls to meet the most exacting specifications.

CURRAN & BARRY

SELLING AGENTS

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320 BROADWAY • NEW YORK 7, N. Y.

COMPOUNDING INGREDIENTS*

Abrasives

Pumicestone, powdered	lb.	$0.025	/ $0.055
Rottenstone, domestic	ton	36.00	/ 43.00

Accelerators, Organic

A-10	lb.	.40	/ .47
A-19	lb.	.52	/ .58
A-32	lb.	.59	/ .69
A-77	lb.	.42	/ .55
A-100	lb.	.42	/ .55
Accelerator 8	lb.	.98	
49	lb.	.48	/ .49
89	lb.	1.20	
122	lb.	1.30	
552	lb.	2.00	
808	lb.	.59	/ .61
833	lb.	1.13	/ 1.15
Aero AC 50	lb.	.50	/ .56
165	lb.	.37	/ .39
Altax	lb.	.38	/ .40
Rodform	lb.	.385	/ .405
Arazate	lb.	2.16	
Beutene	lb.	.59	/ .64
B-J-F	lb.	.27	/ .32
Butasan	lb.	1.00	
Butazate	lb.	1.00	
Butyl Eight	lb.	1.00	/ 1.05
Zimate	lb.	1.00	
Captax	lb.	.30	/ .32
C-P-B	lb.	1.95	
Cumate	lb.	1.45	
Cuprax	lb.	.60	/ .62
Diesterex N	lb.	.50	/ .57
DOTG (diorthotolyguanidine)	lb.	.52	/ .53
DPG (diphenylguanidine)	lb.	.42	/ .45
El-Sixty	lb.	.61	/ .68
Ethasan	lb.	1.00	
Ethazate	lb.	1.00	
Ethex	lb.	1.00	
Ethyl Thiurad	lb.	1.00	
Tuads	lb.	1.00	
Tuex	lb.	1.00	
Zimate	lb.	1.00	
Ethylac	lb.	.88	/ .90
Good-rite Erie	lb.	.32	/ .34
Hepteen	lb.	.42	/ .48
Base	lb.	1.80	/ 1.90
Ledate	lb.	1.00	
M-B-T	lb.	.34	/ .39
-XXX	lb.	.46	/ .48
M-B-T-S	lb.	.42	/ .47
Pellets	lb.	.425	/ .445
Mertax	lb.	.44	/ .51
Methesan	lb.	1.00	
Methazate	lb.	1.00	
Methyl Selenac	lb.	1.60	
Tuads	lb.	1.10	
Zimate	lb.	1.00	
Monex	lb.	1.10	
Mono-Thiurad	lb.	1.10	
Morfex	lb.	.59	/ .64
O-X-A-F	lb.	.43	/ .48
Pentex	lb.	1.00	
Flour	lb.	.20	
Phenex	lb.	.40	/ .45
Pipazate	lb.	1.53	
Rodform products	lb.	1.00	/ 3.00
Rotax	lb.	.42	/ .44
S. A. 52	lb.	1.10	
57, 62, 67, 77	lb.	1.00	
66	lb.	1.45	
Safex	lb.	1.15	
Santocure	lb.	.64	/ .71
Selazate	lb.	1.45	
Selenac	lb.	1.45	
SPDX-GH	lb.	.64	/ .69
Tellurac	lb.	1.45	
Tepidone	lb.	.55	
Tetrone A	lb.	1.85	
Thiofide	lb.	.42	/ .49
Pellets	lb.	.36	/ .43
Thionex	lb.	1.10	
Thiotax	lb.	.34	/ .41
Thiurad	lb.	1.10	
Thiuram E	lb.	1.00	
M	lb.	1.10	
Trimene	lb.	.54	/ .64
Base	lb.	1.03	/ 1.18
Tuex	lb.	1.10	
2-MT	lb.	.75	
Ultex	lb.	1.00	/ 1.10
Ureka Base	lb.	.63	/ .70
C	lb.	.68	/ .75
Vulcanex	lb.	.45	
Z-B-X	lb.	2.45	
Zenite	lb.	.42	/ .44
A	lb.	.50	/ .52
Special	lb.	.43	/ .45
Zetax	lb.	.38	/ .41

Accelerator-Activators, Inorganic

Lime hydrated	ton	9.00	/ 15.00
Litharge, comml.	lb.	.1875	/ .206
Eagle, sublimed	lb.	.1975	/ .1985
National Lead	lb.	.205	/ .206
Red Lead, comml.	lb.	.1975	/ .22
Eagle	lb.	.2075	
National Lead	lb.	.215	
White lead, basic	lb.	.185	/ .195
Eagle, National Lead	lb.	.185	/ .195
White lead, silicate	lb.	$0.1625	/ $0.2225
Eagle	lb.	.2025	/ .2225
National Lead	lb.	.1625	/ .1725
Zinc oxide, comml.†	lb.	.16	/ .1925

Accelerator-Activators, Organic

Aktone A, B	lb.	.22	/ .23
Barak	lb.	.60	
Curade	lb.	.57	/ .59
D-B-A	lb.	1.95	
Delac P	lb.	.45	/ .52
Emersol 110	lb.	.2125	/ .225
120	lb.	.2175	/ .23
130	lb.	.24	/ .2525
210 Elaine	lb.	.2175	/ .245
Emery 600	lb.	.18	/ .2075
Guantal	lb.	.51	/ .58
Hyfac 430	lb.	.2075	/ .22
431	lb.	.2175	/ .23
Laurex	lb.	.29	/ .32
Lead oleate	lb.	.24	
MODX	lb.	.295	/ .345
NA-22	lb.	1.50	
Palmalene	lb.	.35	
Plastone	lb.	.27	/ .30
Polyac	lb.	1.60	
Ridacto	lb.	.25	/ .26
Seedine	lb.	.1485	/ .1705
SOAC-KL	lb.	.08	/ 11
Stearex Beads	lb.	.14⅞	/ .15⅞
Stearic acid, single pressed	lb.	.2325	/ .245
Double pressed	lb.	.2375	/ .25
Triple pressed	lb.	.26	/ .2725
Stearite	lb.	.095	/ .10
Tonox	lb.	.50	/ .59
Zinc stearate	lb.	.46	/ .48

Alkalies

Caustic soda, flake	100 lbs.	3.75	/ 6.77
Liquid, 50%	100 lbs.	2.55	/ 2.75
Solid	100 lbs.	3.35	/ 5.05

Antioxidants

AgeRite Gel	lb.	.60	/ .62
H.P.	lb.	.67	/ .69
Hipar	lb.	.91	/ .93
Powder	lb.	.49	/ .51
Resin	lb.	.65	/ .67
D	lb.	.49	/ .51
Stalite	lb.	.49	/ .51
White	lb.	1.40	/ 1.50
D	lb.	1.45	/ 1.55
Akroflex C, F	lb.	.67	/ .69
Albasan	lb.	.69	/ .73
Aminox	lb.	.49	/ .58
Antioxidant 2246	lb.	1.60	/ 1.63
Antisol	lb.	.23	/ .24
Antox	lb.	.49	/ .51
Aranox	lb.	3.25	
Betanox Special	lb.	.70	/ .79
B-L-E, -25	lb.	.49	/ .58
B-X-A	lb.	.43	/ .52
Copper Inhibiter X-872-L	lb.	1.95	
Flectol H	lb.	.49	/ .56
Flexamine	lb.	.67	/ .76
Heliozone	lb.	.25	/ .26
Ionol	lb.	.95	/ 1.40
NBC	lb.	1.50	
Neozone A	lb.	.51	/ .53
C	lb.	.67	
D	lb.	.45	/ .51
Parazone	lb.	.75	
Perflectol	lb.	.61	/ .68
Permalux	lb.	1.85	
Rio Resin	lb.	.52	/ .54
Santoflex 35	lb.	.67	/ .74
AW	lb.	.66	/ .73
B	lb.	.49	/ .56
BX	lb.	.60	/ .67
Santovar A	lb.	1.40	/ 1.47
O	lb.	1.20	/ 1.27
Santowhite Crystals	lb.	1.55	/ 1.62
L	lb.	.49	/ .56
MK	lb.	1.25	/ 1.32
S.C.R.	lb.	.32	/ .34
Sharples Wax	lb.	.23	/ .28
Stabilite	lb.	.49	/ .51
Alba	lb.	.72	/ .77
L	lb.	.60	/ .62
White	lb.	.49	/ .56
Powder	lb.	.39	/ .43
Sunolite	lb.	.20	
Sunproof	lb.	.25	/ .30
Improved	lb.	.23	/ .28
Jr.	lb.	.18	/ .23
Thermoflex A	lb.	.98	/ 1.00
Tonox	lb.	.50	/ .59
Tysonite	lb.	.215	/ .2225
V-G-B	lb.	.65	/ .74
Wing-Stay S	lb.	.48	/ .58
Zenite	lb.	.33	/ .35

Antiseptics

Copper naphthenate, 6-8%	lb.	.2575	
Pentachlorophenol	lb.	$0.20	/ $0.28
Resorcinol, technical	lb.	.84	/ .85
Zinc naphthenate, 8-10%	lb.	.24	/ .2925

Blowing Agents

Ammonium, bicarbonate	lb.	.055	/ .06
Carbonate	lb.	.23	/ .24
Sodium bicarbonate	100 lbs.	2.10	/ 3.15
Carbonate, technical	100 lbs.	1.20	/ 5.02
Unicel	lb.	.82	
ND	lb.	1.40	
S	lb.	.20	

Bonding Agents

BAC Latex	lb.	.75	/ .80
MDI-50	lb.	2.75	/ 3.25
Ty-Ply BN, Q, S	gal.	6.75	/ 8.00

Brake Lining Saturants

B.R.T. No. 3	lb.	.024	/ .025
Resinex L-S	lb.	.0225	/ .03

Carbon Blacks

Conductive Channel—CC

Continental R-20, -40	lb.	.15	/ .22
Kosmos/Dixie BB	lb.	.18	/ .215
Spheron C	lb.	.14	/ .185
N	lb.	.25	/ .30
Voltex	lb.	.18	/ .315

Easy Processing Channel—EPC

Continental AA	lb.	.069	/ .1175
Kosmobile 77/Dixiedensed 77	lb.	.069	/ .1175
Micronex W-6	lb.	.07	/ .1225
Spheron #9	lb.	.074	/ .1225
Texas E	lb.	.07	/ .1175
Witco #12	lb.	.069	/ .1175
Wyex	lb.	.074	/ .12

Hard Processing Channel—HPC

Continental F	lb.	.069	/ .1175
HX	lb.	.074	/ .12
Kosmobile S/Dixiedensed S	lb.	.069	/ .1175
Micronex Mk. II	lb.	.07	/ .1225
Spheron #4	lb.	.074	/ .1225
Witco #6	lb.	.069	/ .1175

Medium Processing Channel—MPC

Arrow TX	lb.	.074	/ .12
Continental A	lb.	.069	/ .1175
Kosmobile S-66/Dixiedensed S-66	lb.	.069	/ .1175
Micronex Standard	lb.	.07	/ .1225
Spheron #6	lb.	.074	/ .1225
Texas M	lb.	.07	/ .1175
Witco #1	lb.	.069	/ .1175

Conductive Furnace—CF

Statex A	lb.	.08	/ .10

Fast Extruding Furnace—FEF

Statex M	lb.	.0575	/ .10

Fine Furnace—FF

Statex B	lb.	.0625	/ .105
Sterling 99	lb.	.065	/ .105
105	lb.	.12	/ .16

High Abrasion Furnace—HAF

Aromex	lb.	.079	/ .125
Philblack O	lb.	.075	/ .119
Statex R	lb.	.075	/ .125
Vulcan #1, #3	lb.	.079	/ .112

Medium Abrasion Furnace—MAF

Philblack A	lb.	.0575	/ .10

High Modulus Furnace—HMF

Continex HMF	lb.	.05	/ .09
Kosmos 40/Dixie 40	lb.	.05	/ .09
50/Dixie 50	lb.	.055	/ .095
Modulex	lb.	.055	/ .095
Statex 93	lb.	.0525	/ .095
Sterling L	lb.	.055	/ .095
SO	lb.	.06	/ .10

Reinforcing Furnace—RF

Kosmos 60/Dixie 60	lb.	.074	/ .1125

Semi-Reinforcing Furnace—SRF

Continex SRF	lb.	.035	/ .075
Essex	lb.	.04	/ .08
Furnex	lb.	.0375	/ .08
Gastex	lb.	.04	/ .08
Kosmos 20/Dixie 20	lb.	.035	/ .075
Pelletex	lb.	.04	/ .08
Sterling NS, R, S	lb.	.04	/ .08

Very Fine Furnace—VFF

Statex K	lb.	.075	/ .125

Fine Thermal—FT

P-33	lb.	.05	

Medium Thermal—MT

Thermax	lb.	.0325	
Stainless	lb.	.04	

*Prices in general are f.o.b. works. Range indicates grade or quantity variations. Space limitation prevents listing of all known ingredients. Prices are not guaranteed; contact suppliers for spot prices.

†For trade names, see Color—White, Zinc Oxide.

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ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE

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GENERAL RATES
Light face type $1.25 per line (ten words)
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Allow nine words for keyed address.

SITUATIONS WANTED RATES
Light face type 40c per line (ten words)
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SITUATIONS OPEN RATES
Light face type $1.00 per line (ten words)
Bold face type $1.40 per line (eight words)
Letter replies forwarded without charge, but no packages or samples.

Address All Replies to New York Office at 386 Fourth Avenue, New York 16, N. Y.

SITUATIONS OPEN

WANTED: By large national organization, an experienced rubber technologist with knowledge of up-to-date synthetic rubber compounding and processing in the mechanical goods field. This position involves applied research and product and process development in packings and gasketing materials. Modern research facilities ideally located in northeastern New Jersey. Salary commensurate with age and related experience. In replying, give age, educational background and experience and state salary requirement, and how soon available. Our employees have been told of this advertisement. Reply: Box #800, c/o INDIA RUBBER WORLD.

PLANT FOREMAN. MUST BE THOROUGHLY EXPERIENCED on rubber floor tile. Small plant employing 35 people. Chicago location. Salary, $5,000.00 per year plus bonus. Address Box No. 805, care of INDIA RUBBER WORLD.

RUBBER CHEMIST WITH EXPERIENCE IN DEVELOPMENT and production of rubber heels, soles, and soling sheets. Plant located in eastern part of United States is equipped with modern laboratory. Extra-fine association with university trained management and staff offers you a most congenial atmosphere. Write giving age, education, experience, and salary you will accept at start. Replies will be held in strictest confidence. Address Box No. 806, care of INDIA RUBBER WORLD.

SPONGE RUBBER CHEMIST—REQUIRE EXPERIENCED CHEMist who is ambitious and resourceful. Permanent position with sound, well-financed organization. Salary commensurate with ability. Submit detailed résumé first letter. Address Box No. 807, care of INDIA RUBBER WORLD.

PRODUCTION AND DEVELOPMENT: A CHEMIST OR CHEMical engineer familiar with laminating operations, pressure-sensitive tape production, and adhesives for such applications. Progressive New England firm. A letter with full details is requested. Address Box No. 808, care of INDIA RUBBER WORLD.

SALESMAN—MECHANICAL RUBBER PRODUCTS, METROpolitan New York area. Preferably experienced in line and well acquainted with purchasing departments marine and industrial concerns. Exceptional opportunity for high caliber man with eventual possibility assuming executive charge. State all details first letter. Confidential. Address Box No. 809, care of INDIA RUBBER WORLD.

CHEMICAL SUPPLIER WANTS YOUNG MAN, B.S. DEGREE, 2 or 3 years' latex experience, for laboratory work, training toward salesmanship if desired. Address Box No. 810, care of INDIA RUBBER WORLD.

ENGINEER, EXPERIENCED HOSE DEVELOPMENT AND PRODuction. Progressive New Jersey manufacturing company is seeking a permanent staff engineer with knowledge of hose fabrication and braiding. Excellent opportunity, high salary. Company pays agency fee. Mail résumé to: Security Employment Agency, 120 Liberty Street, New York, N. Y.

COMPOUNDER—MUST HAVE CONSIDERABLE EXPERIENCE in mechanical goods of several types. Tire compounding useful, but not necessary. South America for Akron rubber firm. State experience, family status, etc. Address Box No. 813, care of INDIA RUBBER WORLD.

WEST COAST INDEPENDENT—PROGRESSIVE
RUBBER COMPOUNDER

Need graduate chemist or engineer having five or more years' experience compounding and processing all types rubber. Calender sheet and extruded mechanical goods experience preferred. Salary open. Address Box No. 814, care of INDIA RUBBER WORLD.

SITUATIONS WANTED

RUBBER CHEMIST FOR PRODUCTION, TECHNICAL SERVICE compounding and process. Eight years' tires and aircraft manufacture and research; heading 18 people, but individually capable too. 30, family, graduate; making $6,000 base. Address Box No. 801, care of INDIA RUBBER WORLD.

SITUATIONS WANTED (Continued)

RUBBER CHEMIST—AKRON, O., AREA. PART-TIME OR CONsultant work. Experienced in compounding; lab, factory management; production development; small, large plants. Address Box No. 802, care of INDIA RUBBER WORLD.

PLANT ENGINEER AND MASTER MECHANIC CAPABLE OF organizing and supervising general plant maintenance and possessing a broad background of experience and maintenance of all types of processing machinery. Presently employed large rubber foam plant. Address Box No. 803, care of INDIA RUBBER WORLD.

RELIABLE CHEMIST, B.S., TO ASSIST A BUSY CHIEF CHEMist who wants to rely on an experienced and adaptable assistant in the development of adhesive problems. Pressure-sensitive adhesive tapes, laminating cements, adhesives from any rubber, from polymers, from vinylites, from cellulose lacquers, from resins. Quarterlining, vinylite coatings. Thorough factory and laboratory experience. Reliable and working. Address Box No. 804, care of INDIA RUBBER WORLD.

RUBBER CHEMIST—COMPOUNDER: GRADUATE WITH 18 years' experience in large and small rubber plants. Knowledge of all phases of footwear, sponge, molded articles, etc. Production, lab. control. Also experienced with latex. Address Box No. 815, care of INDIA RUBBER WORLD.

BUSINESS OPPORTUNITIES

OPEN TIME FOR GRINDING AND PULVERIZING OF MANY friable plastic resins and scrap to your specifications. Phone New Haven 8-6151. ELM CITY RUBBER CO., Box 1864, New Haven, Conn.

FOR SALE: CONTROLLING INTEREST. MECHANICAL RUBBER molding plant. Suburb of Detroit, Mich. Address Box No. 811, care of INDIA RUBBER WORLD.

RUBBER AND GR-S MIXING, COMPOUNDING, AND CALENDERing. All work done under careful supervision. Contract work invited. Phone New Haven 8-6151. ELM CITY RUBBER CO., Box 1864, New Haven, Conn.

MANUFACTURING BUSINESS WANTED

We are now manufacturing over $20,000,000 in various lines and wish to expand by acquisition of assets or stock of one or more industrial companies. In our negotiations the sellers' problems and wishes will receive full consideration. Present personnel will normally be retained.
Address all replies "confidentially" C. J. GALE, Sec., 233 Broadway, New York 7, N. Y. BArclay 7-1819.

MIXING AND MASTICATION CAPACITY AVAILABLE to customers' specifications on No. 3A Banbury Type Machine. We are manufacturers of Molded, Lathe Cut, and Extruded Soft Rubber Goods and have surplus mixing capacity.

MARTIN RUBBER COMPANY
Long Branch Ave., Long Branch, N. J.
Telephones: Long Branch 6-1221-1222

WANTED

Financially responsible organization will purchase complete sponge and mechanical rubber goods plant with presses, calenders, mills and extruders. Will consider all offers. Please give complete details first letter.
Address Box 555,
c/o INDIA RUBBER WORLD

(Classified Advertisements Continued on Page 383)

Chemical Stabilizers

Advastab #21	lb.	$1.06	/	$1.12
Dutch Boy DS-207	lb.	.57	/	.59
Dyphos	lb.	.5875	/	.6075
Dythal	lb.	.415	/	.435
Normasal	lb.	.4675	/	.4875
Plumb-O-Sil A	lb.	.2925	/	.3125
B	lb.	.3075	/	.3275
C	lb.	.3325	/	.3525
Tribase	lb.	.265	/	.285
E	lb.	.2325	/	.2525
Stabilizer #3, #52	lb.	2.10	/	2.20
B-5	lb.	.70	/	.75
BC-12	lb.	1.03	/	1.10
E-6-B	lb.	.90	/	1.00
JCX	lb.	.67	/	.76
L Paste	lb.	.60	/	.65
SN	lb.	.47	/	.53
V-I-N	lb.	.42	/	.50
Dry Powder	lb.	.75	/	.80
V-9	lb.	.85	/	.90
VL-2	lb.	1.26	/	1.32
-3	lb.	1.17	/	1.23
Vanstay 16, 25	lb.	.33	/	.35
H	lb.	.75	/	.77
Witco Lead Stearate #50	lb.	.5025		
Stabilizer #70	lb.	1.25		

Colors

Black

Black Paste #25	lb.	.22	/	.40
BK Iron Oxides	lb.	.11	/	.1125
Covinylblaks	lb.	.62	/	1.14
Lampblack, comml.	lb.	.077	/	.33
Superjet	lb.	.075	/	.11
Mapico	lb.	.1175	/	.12
MB Mineral Blacks	lb.	.0315	/	.0675

Blue

Du Pont	lb.	1.77	/	4.55
Heveatex pastes	lb.	.80	/	1.45
Stan-tone	lb.	1.00	/	1.35
Toners	lb.	.30	/	3.50

Brown

Brown Paste #5, #10	lb.	.35	/	.45
Mapico	lb.	.1275	/	.13
Tan	lb.	.1975	/	.20
Metallic brown	lb.	.0315	/	.044
Plastics brown	lb.	.0625	/	.07
Sienna, burnt	lb.	.0425	/	.155
Raw	lb.	.045	/	.1325
Umber, burnt	lb.	.06	/	.065
Raw	lb.	.0625	/	.0675

Green

Chrome	lb.	.17	/	.4875
Oxide	lb.	.375	/	1.20
Du Pont	lb.	1.50	/	3.20
G-4099, -6099	lb.	.34	/	.345
G-7599	lb.	.405	/	.41
GH-9869	lb.	.85	/	1.00
9976	lb.	.95	/	1.10
Heveatex pastes	lb.	.95	/	1.85
Stan-Tone	lb.	1.50	/	3.30
Toners	lb.	.35	/	4.00

Orange

Du Pont	lb.	2.75		
Orange Paste #13	lb.	1.35	/	1.50
Stan-Tone	lb.	1.65	/	2.25
Toners	lb.	.30	/	1.50

Red

Antimony trisulfide	lb.	.42	/	.425
R. M. P. No. 3	lb.	.55	/	.60
R. M. P. Sulfur Free	lb.	.63	/	.68
Cadmium red lithopone	lb.	1.70	/	2.10
Du Pont	lb.	1.32	/	1.80
Indian Red	lb.	.125	/	.12
Iron oxide, red	lb.	.0525	/	.0925
Light	lb.	.1175	/	.12
Mapico	lb.	.1225	/	.125
Red Paste #17, I-2	lb.	.95	/	1.10
Rub-Er-Red	lb.	.0975		
Stan-Tone	lb.	1.10	/	3.05
Toners	lb.	.25	/	4.15

White

Antimony oxide	lb.	.34	/	.46
Burgess Iceberg	ton	50.00		
Lithopone, titanated	lb.	.09 5/8	/	.10 5/8
Cryptone BT	lb.	.09 5/8	/	.10 5/8
Titanium pigments				
Rayox LW	lb.	.195	/	.205
R-110	lb.	.215	/	.225
Ti-Cal	lb.	.075	/	.0825
Ti-Pure	lb.	.195	/	.225
Titanox A-168, -LO, -MO	lb.	.195	/	.205
RA, RA-10	lb.	.215	/	.225
RCHT	lb.	.075	/	.08
Zopaque	lb.	.195	/	.205
Zinc oxide, comml.	lb.	.16	/	.1925
Azo ZZZ-11, -44, -55	lb.	.16	/	.17
66	lb.	.1825	/	.1925
35% leaded	lb.	.16 5/8	/	.17 5/8
Eagle AAA, lead free	lb.	.16	/	.17
5% leaded	lb.	.16	/	.17
35% leaded	lb.	.16 5/8	/	.17 5/8
50% leaded	lb.	.16 7/8	/	.17 7/8
Florence Green Seal	lb.	.1775	/	.1875
Red Seal	lb.	.1725	/	.1825
White Seal	lb.	.1825	/	.1925
Horsehead XX-4, -78	lb.	.16	/	.17
Kadox-15, -17, -22	lb.	.16	/	.17
-25	lb.	.1825	/	.1925
Lehigh, 35% leaded	lb.	$0.16 5/8	/	$0.17 5/8
50% leaded	lb.	.16 7/8	/	.17 7/8
Protox-166, -167	lb.	.16	/	.17
St. Joe, lead free	lb.	.16	/	.17
Standard, 5% leaded	lb.	.16	/	.17
Zinc sulfide, comml.	lb.	.24		
Cryptone ZS	lb.	.20	/	.21

Yellow

Cadmium yellow lithopone	lb.	1.32		
Chrome	lb.	.32		
Du Pont	lb.	1.62	/	2.15
Iron oxide, yellow	lb.	.0141	/	.0975
Mapico	lb.	.10	/	.1025
Stan-Tone	lb.	1.00	/	1.55
Toners	lb.	.50	/	1.37
Yellow D	lb.	1.25	/	1.35

Dispersing Agents

Darvan Nos. 1, 2	lb.	.21	/	.30
Stan-Chem	lb.	.1225	/	.2587
Triton R-100	lb.	.12	/	.25

Dusting Agents

D-Tac	lb.	.21	/	.23
Extrud-o-Lube conc.	gal.	1.65		
Glycerized Liquid, Lubricant, concentrated	gal.	1.48		
Lubrex	lb.	.25	/	.30
Mica	lb.	.07	/	.0775
Pyrax A	ton	12.50		
W. A.	ton	15.00		
Snow Crest Talc	ton	33.00	/	35.00
Vanfre	gal.	2.00	/	2.50

Extenders

Advagum 1098	lb.	.61	/	.69
B. R. S. 700	lb.	.0175	/	.026
B. R. T. No. 7	lb.	.0265	/	.0275
Dielex B	lb.	.06		
Factice, Amberex	lb.	.30	/	.38
Brown	lb.	.12	/	.33
Neophax	lb.	.18	/	1.35
Ozonite	lb.	.2365		
White	lb.	.13	/	.32
G. B. Asphaltenes	lb.	.06	/	.065
Mineral Rubbers				
Black Diamond	ton	38.00	/	40.00
Extender 600	lb.	.18		
Hard Hydrocarbon	ton	38.00	/	40.00
No. 38	ton	38.00	/	40.00
Parmr	ton	21.00	/	29.00
Nuba No. 1, 2	lb.	.04		
3X	lb.	.065		
Rubber substitute, brown	lb.	.18	/	.317
White	lb.	.16	/	.33
Sublac B-2, PX-5	lb.	.26	/	.28
Synthetic 100	lb.	.41		

Fillers, Inert

Barytes, floated, white	ton	37.60	/	61.75
Off-color, domestic	ton	19.00	/	20.00
No. 1	ton	37.60	/	52.40
2	ton	35.60	/	50.40
Blanc fixe	ton	90.00	/	140.00
Clays				
Albacar	ton	40.00	/	50.00
Aluminum Flake	ton	16.00	/	22.00
#5	ton	21.00		
Champion	ton	14.00		
Crown	ton	14.00	/	33.00
Hi-White R	ton	13.50	/	33.00
Hydratex R	ton	30.00		
Paragon	ton	13.50	/	31.50
McNamee	ton	13.50		
RX-43	ton	33.00		
Stan-Tex White	ton	25.00		
Stellar-R	ton	50.00		
Suprex	ton	14.00	/	33.00
W-1291 English	ton	53.00	/	55.00
Witco #1	ton	14.00	/	30.00
#2	ton	13.50	/	30.00
Cryptone BA, CB, MS	lb.	.08	/	.0825
Flocks				
Cotton, dark	lb.	.095	/	.112
Dyed	lb.	.45	/	.85
White	lb.	.12	/	.20
Fabrifil X-24-G	lb.	.095		
X-24-W	lb.	.135		
Filfloc 6000	lb.	.16		
F-40-900	lb.	.105		
Solka-Floc	lb.	.05	/	.15
Kalite	ton	50.00		
Lithopone, comml.	lb.	.075	/	.085
Albalith	lb.	.075	/	.085
Astrolith	lb.	.063/4	/	.0675
Eagle	lb.	.0725	/	.075
Sunolith	lb.	.063/4	/	.0675
Mica	lb.	.07	/	.0775
Millical	ton	32.50		
No. 1 Silica	ton	22.00	/	40.00
Non-Fer-Al	ton	25.00		
Purecal D	ton	50.00	/	65.00
M	ton	45.00	/	65.00
Pyrax A	ton	12.50		
W. A.	ton	15.00		
SL Slate Flour	ton	17.00	/	25.00
Suspenso	ton	30.00		
Terra Alba 1319	ton	27.00		
Ti-Cal	lb.	.0675		
Whiting, limestone	ton	6.00	/	15.00
Paxinosa	ton	9.00	/	17.00
Witco	ton	8.50		

Finishes

Black-Out	gal.	4.50	/	8.00
Flexible Rubber Paints	gal.	4.00	/	9.00
Flocks				
Cotton, dark	lb.	$0.095	/	$0.112
Dyed	lb.	.45	/	.85
White	lb.	.12	/	.20
Rayon, colored	lb.	.90	/	1.50
White	lb.	.75	/	1.25
Rubber lacquer, clear	gal.	1.00	/	2.00
Colored	gal.	2.00	/	3.50
Shoe varnish	gal.	1.45		
Talc	ton	12.50	/	35.00
Wax, Bees	lb.	.70	/	.82
Carnauba	lb.	1.18	/	1.32
Montan	lb.	.155	/	.32
No. 118, colors	gal.	.86	/	1.41
Neutral	gal.	.76	/	1.31
Van Wax	gal.	1.25	/	1.30

Latex Compounding Ingredients

Accelerator 80	lb.	1.20		
122	lb.	1.30		
552	lb.	1.80		
Aerosol	lb.	.35		
Agerite Dispersions	lb.	.60	/	2.25
Amberex Solutions	lb.	.1675	/	.18
Aquablaks	lb.	.0725	/	.1775
Aquarex D	lb.	.80		
L Paste	lb.	.94		
MDL Paste	lb.	.33		
ME	lb.	.97		
NS	lb.	.60		
SMO	lb.	.50		
WA Paste	lb.	.28		
Areskap 50	lb.	.30	/	.38
100, dry	lb.	.60	/	.72
Aresket 240	lb.	.30	/	.38
300, dry	lb.	.60	/	.72
Aresklene 375	lb.	.42	/	.57
400, dry	lb.	.70	/	.84
Black No. 25, dispersed	lb.	.22		
Casein	lb.	.40	/	.45
CW-12	lb.	.85		
CW-37	lb.	.70		
DC Antifoam A	lb.	5.65	/	6.65
Dispersed Sulfur No. 2	lb.	.10	/	.12
Ethyl Thiurad	lb.	1.00		
Factice dispersions	lb.	.23	/	.44
Habuco Resin Emulsion				
#226	lb.	1.05		
#2246	lb.	1.30		
#2402, #2343	lb.	1.60		
Laton L	lb.	.075	/	.0775
Ludox	lb.	.1675	/	.1925
Marmix	lb.	.41	/	.48
Methocel	lb.	.62	/	.80
Micronex, colloidal	lb.	.06	/	.07
Pip-Pip	lb.	2.00		
Pliolite Latex 150, 190	lb.	.32	/	.41
170	lb.	.37	/	.46
Polyca 117-SS	lb.	.18	/	.265
296	lb.	.13	/	.185
350	lb.	.25	/	.37
R-2 Crystals	lb.	1.95		
Resin Emulsion A-155	lb.	.13	/	.18
P-370	lb.	.125	/	.175
Resin V	lb.	.13		
Santomerse D	lb.	.44	/	.65
S	lb.	.13	/	.25
Setsit No. 5	lb.	1.00		
SPDX-GL	lb.	.95		
Stablex A	lb.	.90	/	1.10
B	lb.	.50	/	.95
G	lb.	.50	/	.70
L	lb.	.30	/	.40
Sulfur Dispersion, 50%	lb.	.07	/	.15
66%	lb.	.09	/	.17
73%	lb.	.10	/	.12
Tergitol wetting agents	lb.	.265	/	.37
Thiocarbanilide (A-1)	lb.	.44	/	.51
Zinc oxide, dispersed	lb.	.13	/	.20

Mold Lubricants

Aquarex D	lb.	.76		
L Paste	lb.	.85		
MDL Paste	lb.	.30		
WA Paste	lb.	.25		
Carbowax compounds	lb.	.29	/	.295
Colite Concentrate	gal.	.90	/	1.15
ELA	lb.	.80		
DC Mold Release Fluid	lb.	4.14	/	6.00
Emulsion Nos. 35, 35A, 35B	lb.	1.68	/	3.50
DC 7	lb.	6.20	/	6.80
Glycerized Liquid Lubricant, concentrated	gal.	1.48		
Lubrex	lb.	.25	/	.30
Mold Paste	lb.	.25		
Monten Wax	lb.	.57		
Para Lube	lb.	.046	/	.048
Polyethylene Glycols	lb.	.23		
Sodium stearate	lb.	.51	/	.56
Stearite	lb.	.095	/	.10
Vanfre	gal.	2.00	/	2.50

Odorants

Alamasks	lb.	.60	/	6.50
Curodex 19	lb.	4.75		
188	lb.	5.75		
198	lb.	6.75		
Rodo No. 0	lb.	4.00	/	4.50
No. 10	lb.	5.00	/	5.50

Plasticizers and Softeners

Akroflex C	lb.	.61	/	.63
Aro Lene #1980	lb.	.10	/	.12

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY AND SUPPLIES FOR SALE

FOR SALE: LINE OF 2 FARREL 60″ MILLS, COMPLETE with 200 H.P. synchronized motor; 1 Farrel-Birmingham 22 x 60 latest type Mill, chrome-plated rolls with drive and 125 H.P. motor; 1—20″ x 40″ Mill with drive and 75 H.P. motor; 1 Royle #4 Tuber, stainless steel screw and liner; 1—6′ x 18′ high-pressure Vulcanizer with quick-opening door. Send us your inquiries. CONSOLIDATED PRODUCTS CO., INC., 13-16 Park Row, New York 38, N. Y.

FOR SALE: BANBURY MIXERS, MILLS, CALENDERS, LABORatory Mill and Banbury Unit, Extruders, Tubers, Hydraulic Presses. Send for detailed bulletin. EAGLE INDUSTRIES, Inc., 10 Washington Street, New York 6, N. Y. Digby 4-8364-5-6.

FOR SALE: 8 PELLET PRESSES, KUX MODEL 25 (21 PUNCH and 25 punch); Stokes D-3 and D-4. Read Co. 250 gal. heavy-duty double-arm sigma blade jacketed mixers. PERRY EQUIPMENT CORP., 1524 W. Thompson St., Phila., 21, Pa.

FOR SALE: FARREL 18″ x 45″, 16″ x 48″, AND 15″ x 36″, 2-ROLL Rubber Mills, also new Lab. 6″ x 12″ Mixing Mills and Calenders, & other sizes up to 84″. Rubber Calenders. Extruders 2″ to 3″. Rotary Cutters. Sargent 3-apron conveyer, 6-fan Rubber Dryer. Baker-Perkins Mixers 200 & 9 gal., heavy-duty double-arm. Impregnating Units Lab. size and up. Large stock Hydraulic Presses from 12″ x 12″ to 42″ x 48″ platens, from 50 to 1,500 tons. Hydraulic Pumps and Accumulators. Grinders, Crushers, Churns, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT COMPANY, 90 WEST STREET, NEW YORK 6, N. Y.

FOR SALE: NEW 24 x 24-INCH 200-TON STEWART BOLLING molding press 16″ ram 16″ stroke. Three 5″ openings, 3″ thick electrically heated platens 230-volt with control and contactors.
IMMEDIATE DELIVERY
One 200-gallon used cement churn, good condition. Address PARKER MANUFACTURING CO., INC., 6501 High Drive, Kansas City, Mo.

FOR SALE: WALLACE HARDNESS TESTER FOR RUBBER. Hardly used. Cheap. Address Box No. 812, care of INDIA RUBBER WORLD.

FOR SALE!
THROPP RUBBER MILL
14″ x 36″, 40 hp. 220-3-60 slip ring motor drive.
Steamheated rolls. Excellent condition.
STOKES VACUUM PUMP
Model 212D, 3 hp. 220-440 motor. NEW.
WEBER MACHINERY CO.
1801 E. 21st St., Cleveland, Ohio. Ch 1-7057

EXPERT BANBURY REBUILDING SERVICE. MORE IMportant than ever. Over 16 years' specialized experience at your service. Banbury bodies and parts on hand for quick interchange or sale. Spare parts for most sizes, including rotors, end frames, rotor collars, side jackets, door tops, gland rings, hoppers, and many others. Put your rebuilding in the hands of veterans in the business. For details and prices write INTERSTATE WELDING SERVICE, Offices, Metropolitan Building, Akron, Ohio.

AIR BAG BUFFING MACHINERY
STOCK SHELLS HOSE POLES
MANDRELS
NATIONAL SHERARDIZING & MACHINE CO.
868 WINDSOR ST. HARTFORD, CONN.
Representatives
Akron San Francisco New York

For Your
RUBBER MACHINERY
Buys of the month . . . . .

MILLS
24″ x 84″
20″ x 60″
16″ x 40″
16″ x 36″
14″ x 30″
10″ x 24″
6″ x 12″
PRESSES
20″ x 20″—10″ rams
24″ x 24″—18″ rams (new & used)
40″ x 40″ Mechanical Press
42″ x 42″
36″ x 36″—30″ rams
12″ x 12″
30″ x 60″ sponge type (several)
CALENDERS
28″ x 78″
24″ x 66″
14″ x 42″
10″ x 24″

ALSO —
#9 Banbury Body
12″ Extruder
Hose Braider
Pelletizer
Masticator
36″ x 48″ Vulcanizer
Rotary Knife Stock Cutter
Scrap Chopper & Grinder
Vacuum Pump
130 H.P. Reduction Drive 9-2/3 to 1
19 x 24 x 30″ Farrel Refiner

In addition to the above we have available any and all machinery necessary for the processing of rubber
AKRON RUBBER MACHINERY CO.
P. O. Box 88 Phone WAlbridge 1183-4 Akron, O.

Economical NEW Efficient
Mills - Spreaders - Churns
Mixers - Hydraulic Presses
Calenders
. . . GUARANTEED . . .
Rebuilt Machinery for Rubber and Plastics
LAWRENCE N. BARRY
41 Locust Street Medford, Mass.

NEW and REBUILT MACHINERY
Since 1891
L. ALBERT & SON
Trenton, N. J., Akron, Ohio, Chicago, Ill., Los Angeles, Calif.

GUARANTEED REBUILT MACHINERY
IMMEDIATE DELIVERIES FROM STOCK
MILLS, CALENDERS, TUBERS
VULCANIZERS, ACCUMULATORS
UNITED
HYD. PRESSES, PUMPS, MIXERS
CUTTING MACHINES, PULVERIZERS
UNITED RUBBER MACHINERY EXCHANGE
183-189 ORATON ST. CABLE "URME" NEWARK 4, N. J.

(Classified Advertisements Continued on Page 385)

Bardol	lb.	$0.025	/ $0.035
639	lb.	.025	/ .0425
B	lb.	.0575	/ .06
Bondogen	lb.	.55	/ .60
BRC 20	lb.	.015	/ .016
30	lb.	.0115	/ .02
521	lb.	.019	/ .02
B. R. H. No. 2	lb.	.02	/ .029
B. R. S. 700	lb.	.0175	/ .026
B. R. T. No. 7	lb.	.0265	/ .0275
B. R. V	lb.	.035	/ .0515
Bunarex Liquid	lb.	.0425	/ .0555
Resins	lb.	.065	/ .1225
Bunnatol G. S	lb.	.40	/ 505
Butac	lb.	.125	/ .135
BxDC	lb.	.40	/ .41
Cabflex DI-BA	lb.	.42	/ .4475
-OA	lb.	.435	/ .4625
-OP	lb.	.40	/ .4275
Carbonex	lb.	.0325	/ .0375
664	lb.	.0375	/ .0425
645	lb.	.036	/ .0385
S	lb.	.0425	/ .0475
S Plastic	lb.	.041	/ .046
Contogums	lb.	.0875	/ .111
Cumar EX	lb.	.0525	
MH	lb.	.065	/ .11
V	lb.	.0975	/ .1275
Dielex R	lb.	.06	
Dipolymer Oil	gal.	.33	/ .38
Dispersing Oil No. 10	lb.	.055	/ .0575
Duraplex C-50 LV, 100%	lb.	.25	/ .295
Dutrex 6	lb.	.025	/ .035
Flexol Plasticizer 3GH	lb.	.42	/ .44
3GO	lb.	.515	/ .535
4GO	lb.	.36	/ .38
8N8	lb.	.375	/ .395
DOP	lb.	.43	/ .455
R-I	lb.	.47	/ .475
TOP	lb.	.47	/ .49
TWS	lb.	.405	/ .425
Galex W-100	lb.	.135	/ .1725
W-100D	lb.	.1325	/ .17
Gilsowax B	lb.	.09	/ .11
Heavy Resin Oil	lb.	.0225	/ .0375
Hercolyn	lb.	.1112	/ .1347
Indonex	gal.	.11	/ .17
Nevillac oils	lb.	.33	
Resins	lb.	.31	/ .45
Neville LX-685	lb.	.12	
R Resins	lb.	.105	/ .155
Nevinol	lb.	.17	
Nevoll	lb.	.0325	/ .0425
No. 1-D heavy oil	lb.	.055	
Palmalene	lb.	.15	
Panaflex BN-1	lb.	.18	/ .2325
Para Flux, regular	gal.	.10	/ .2025
No. 2016	gal.	.165	/ .24
Heavy	gal.	.155	
Para Lube	lb.	.046	/ .048
Para Resins	lb.	.04	/ .045
Paradene Resins	lb.	.065	/ .075
Peptizene #2	lb.	.90	
Pepton 22	lb.	.72	/ .75
Picco Resins	lb.	.13	/ .185
480 Oilproof Series	lb.	.18	/ .23
S. O. S	gal.	.29	/ .34
Piccocizers	lb.	.04	/ .068
Piccolastic Resins	lb.	.1855	/ .34
Piccolyte Resins	lb.	.185	/ .25
Piccoumaron Resins	lb.	.07	/ .185
Piccovars	lb.	.145	/ .20
Piccovol	lb.	.025	/ .038
Pictar	gal.	.25	/ .30
Pigmentar	gal.	.041	/ .0511
Pigmentaroil	gal.	.041	/ .0511
Plastender S	lb.	.04	/ .0425
Plasticizer 35	lb.	.205	/ .24
36	lb.	.305	/ .34
42	lb.	.34	/ .40
2175	lb.	.46	/ .56
3425	lb.	.605	
3497	lb.	.61	
3560	lb.	.56	
B	lb.	.35	/ .45
SC	lb.	.50	/ .57
Plastoflex 50, 55	lb.	.40	/ .45
52	lb.	.375	/ .435
VS	lb.	.50	/ .56
Plastogen	lb.	.0775	/ .08
Plastone	lb.	.22	/ .30
Polymer 6	lb.	.0675	/ .10
7	lb.	.23	/ .28
C-128	lb.	.195	/ .205
D, H-2	lb.	.22	/ .24
PT67 Light Pine Oil	gal.	.50	/ .60
101 Pine Tar Oil	lb.	.041	/ .0534
400 Light Pine Tar	lb.	.041	/ .0534
600 Med. Pine Tar	lb.	.041	/ .0534
R-19, R-21 Resins	lb.	.1075	
Reogen	lb.	.1175	/ .12
Resin C pitch	lb.	.02	/ .0285
R6-3	lb.	.38	/ .40
Resinex	lb.	.0325	/ .0375
L-4	lb.	.0225	/ .03
Rosin Oil, Sunny South	gal.	.50	/ .66
RPA No. 2	lb.	.75	
No. 3 RO	lb.	.49	
5	lb.	.57	
RSN Flux	gal.	.10	/ .19
Rubber Oil B-5	lb.	.0225	/ .0355
Rubberol	lb.	.2575	
S-Polymers	lb.	.44	
Santicizer B-16	lb.	.52	/ .57
E-15	lb.	.49	/ .54
M-17	lb.	.46	/ .51
No. 140	lb.	.3225	/ .38
Seedine	lb.	.1485	/ .1705
Softener #20	gal.	.10	/ .20
Solvenol	gal.	.56	/ .58
Staybelite Resin	lb.	$0.06	/ $0.065
Stearex Beads	lb.	.14⅞	/ .15⅞
Stearite	lb.	.095	/ .10
Syn-Tac	gal.	.33	/ .35
Synthol	lb.	.205	
TR-11	lb.	.035	
Turgum S	lb.	.1075	/ .1175
Tysonite	lb.	.215	/ .2225
X-1 Resinous Oil	lb.	.0175	/ .0325
XX-100 Resin	lb.	.0525	

Reclaiming Oils

Bardol	lb.	.025	/ .035
639	lb.	.025	/ .0425
B	lb.	.0575	/ .06
B. R. H. No. 2	lb.	.02	/ .029
B. R. T. No. 4	lb.	.0225	/ .0235
B. R. V	lb.	.035	/ .0515
BWH-1	lb.	.14	
Dipolymer Oil	gal.	.33	/ .43
Dispersing Oil No. 10	lb.	.055	/ .0575
Heavy Resin Oil	lb.	.0225	/ .0375
LX-77	gal.	.18	/ .30
-572	gal.	.23	/ .34
No. 1621	lb.	.025	/ .035
3186	gal.	.28	/ .295
Picco 6535	gal.	.25	/ .30
C-33	gal.	.215	/ .315
C-42	gal.	.23	/ .33
D-4	gal.	.27	/ .37
E-5	gal.	.25	/ .35
Q-Oil	gal.	.286	/ .36
PT 101 Pine Tar Oil	lb.	.041	/ .034
150 Pine Solvent	gal.	.44	/ .553
RR-10	lb.	.35	
Solvenol	gal.	.56	/ .58
S. R. O	lb.	.015	/ .0225
Wilcor Nos. 111, 151	gal.	.26	/ .30
X-1 Resinous Oil	lb.	.0175	/ .0325
-60 Solvent	gal.	.24	/ .38

Reinforcers, Other Than Carbon Black

Amorez 11-190	lb.	.04	/ .055
BRC 20	lb.	.015	/ .016
30	lb.	.0115	/ .02
521	lb.	.019	/ .02
Bunarex resins	lb.	.065	/ .1225
Calcene T	ton	75.00	/ 95.00
Calco S. A	lb.	.80	/ .83
Carbonex	lb.	.0325	/ .0375
644	lb.	.0375	/ .0425
645	lb.	.036	/ .0385
S	lb.	.0425	/ .0475
S Plastic	lb.	.041	/ .046
Clays			
Aluminum Flake	ton	16.50	/ 22.50
No. 5	ton	21.00	
Buca	ton	40.00	
Burgess Iceberg	ton	50.00	
Pigment No. 20	ton	35.00	
No. 30	ton	37.00	
Polyclay	ton	45.00	
Catalpo	ton	30.00	
Crown	ton	14.00	/ 33.00
Dixie	ton	14.00	
Hydratex R	ton	30.00	
L. G. B	ton	17.00	
Paragon (R)	ton	13.50	/ 31.50
Pigment No. 33	ton	30.00	
Suprex	ton	14.00	/ 32.00
Witco No. 1	ton	14.00	/ 30.00
No. 2	ton	13.50	/ 30.00
Clearcarb	lb.	.1175	/ .1225
Cumar EX	lb.	.0525	
MH	lb.	.065	/ .1175
V	lb.	.0975	/ .1275
G Resin	lb.	.08	
Good-rite Resin 50	lb.	.36	/ .38
Hi-Sil	lb.	.11	/ .125
Kralac A	lb.	.39	/ .50
Magnesia, calcined	lb.	.31	/ .3475
Marbon resins	lb.	.41	/ .48
Multiflex MM	ton	110.00	
Neville R Resins	lb.	.10	/ .155
Panarez resins	lb.	.04	/ .13
Para Resins 2457, 2718	lb.	.04	/ .45
Pico Resins	lb.	.13	/ .185
Piccolyte Resins	lb.	.185	/ .25
Piccoumaron Resins	lb.	.07	/ .185
Piccovars	lb.	.145	/ .20
Pliolite, S-3, -6, -6B	lb.	.41	/ .48
S-6 Masterbatches	lb.	.42	/ .69
PS-60 Resin	lb.	.35	
Purecal U	ton	120.00	/ 135.00
Resin C Pitch	lb.	.02	/ .0285
Resinex	lb.	.0325	/ .0375
Rubber Resin LM-4	lb.	.28	/ .35
S-Polymers	lb.	.44	
Silene EF	ton	120.00	/ 140.00
L	ton	125.00	/ 145.00
Super Multifex	ton	160.00	
Witcarb R	ton	105.00	/ 120.00
R-12	ton	45.00	/ 66.00
Zinc oxide, commercial†	lb.	.16	/ .1925

Retarders

Cumar RH	lb.	.105	
Delac J	lb.	.55	/ .60
E-S-E-N	lb.	.36	
Good-rite Vultrol	lb.	.55	/ .57
R-17 Resin	lb.	.1075	
Retarder ASA	lb.	.55	
PD	lb.	.34	/ .36
W	lb.	.43	
Retardex	lb.	.51	/ .54
RM	lb.	1.25	
Thionex	lb.	$1.25	
Vultrol	lb.	.50	/ $0.55

Solvents

Bondogen	lb.	.55	/ .60
Cosol	gal.	.30	/ .38
Dichloro Pentanes	gal.	.04	/ .07
Dipentene DD	gal.	.47	/ .50
GVL	lb.	1.00	
Nevsol	gal.	.185	/ .25
Panasol High-Solvency			
Naphtha	gal.	.19	/ .28
Penetrell	gal.	.47	/ .50
Picco Hi-Solv Solvents	gal.	.17	/ .24
Pine Oil D.D	gal.	.755	/ .765
PT 150 Pine Solvent	gal.	.44	/ .55
Skellysolve-E	gal.	.153	
-H	gal.	.133	
-R, -V	gal.	.109	
-S	gal.	.099	
Tollac	gal.	.195	/ .25
2 50-W Hi-Flash Solvent	gal.	.37	

Synthetic Resins

Geon Latices (dry wt.)	lb.	.465	/ .60
Paste Resins	lb.	.34	/ .60
Plastics	lb.	.365	/ .85
Polyblend	lb.	.43	/ .58
Polyvinol resins	lb.	.34	/ .58
Marvinol VR-10, -20	lb.	.36	/ .52

Synthetic Rubbers and Latices

Chemigum 30N4NS,			
50N4NS	lb.	.50	/ .57
N1NS	lb.	.64	/ .71
N3NS	lb.	.58	/ .65
Latex (dry wt.)			
101-A, -AX, -E	lb.	.32	/ .41
200	lb.	.425	/ .525
235-A, -B	lb.	.50	/ .60
245-A, -B	lb.	.425	/ .525
Hycar OR-15, -15EP	lb.	.52	/ .53
OR-25, -25 EP	lb.	.45	/ .46
OR-25 NS	lb.	.47	/ .48
OS-10	lb.	.50	/ .51
Hycar Latex (dry wt.)			
1501, 1531, 1551	lb.	.49	/ .54
1502, 1552, 1562	lb.	.42	/ .47
1532	lb.	.435	/ .485
Neoprene Latex (dry wt.)			
Type 571, 842, 842-A	lb.	.35	/ .46
572, 700	lb.	.36	/ .47
601, 601-A	lb.	.38	/ .49
735	lb.	.36	/ .47
Neoprene Type AC, CG	lb.	.50	/ .53
E	lb.	.65	/ .68
FR	lb.	.80	/ .83
KNR	lb.	.75	/ .78
GN, GN-A, S	lb.	.38	/ .41
RT, W	lb.	.40	/ .43
Paracril 18-80	lb.	.43	/ .45
26NS60, 26NS90	lb.	.44	/ .46
35NS90	lb.	.51	/ .53
Paraplex X-100	lb.	1.00	
Silastic	lb.	2.35	/ 4.05

Tackifiers

Bunarex resins	lb.	.065	/ .1225
Contogums	lb.	.0875	/ .11
Galex W-100	lb.	.135	/ .1725
W-100D	lb.	.1325	/ .17
Hercolyn	lb.	.1122	/ .1347
Indopol H-100	gal.	.85	/ 1.00
H-300	gal.	1.12	/ 1.27
Natac	lb.	.12	/ .13
Nevindene	lb.	.125	/ .155
Picco resins	lb.	.13	/ .185
Piccolastic resins	lb.	.1855	/ .34
Piccolyte resins	lb.	.185	/ .25
Piccoumaron resins	lb.	.07	/ .185
Staybelite Resin	lb.	.06	/ .065
Synthetic 100	lb.	.41	
Synthol	lb.	.2475	
Vistac	lb.	1.00	/ 1.16
A	lb.	.215	/ .2725
P	lb.	.18	/ .235

Vulcanizing Agents

Dibenzo G-M-F	lb.	2.50	
Ethyl Tuads	lb.	1.00	
G-M-F	lb.	2.50	
Litharge, commercial	lb.	.1875	/ .206
Eagle, sublimed	lb.	.1975	/ .1985
National Lead	lb.	.205	/ .206
Magnesia, calcined	lb.	.31	/ .3475
Methyl Selenac	lb.	1.60	
Tuads	lb.	1.10	
Red Lead, commercial	lb.	.1975	/ .22
Eagle	lb.	.2075	
National Lead	lb.	.215	
Sulfur flour, comml.	100 lbs.	1.70	/ 2.20
Black Bird	lb.	.036	/ .041
Calco	lb.	.0195	/ .053
Crystex	lb.	.195	
Insoluble 60M	lb.	.125	/ .13
Rubbermakers	100 lbs.	2.25	/ 3.80
Spider Brand	lb.	.023	/ .044
Stauffer	lb.	.0175	/ .0285
Telloy	lb.	2.00	
Vandex	lb.	2.00	
Vultac Nos. 1, 2	lb.	.45	/ .47
No. 3	lb.	.49	/ .51
White lead silicate	lb.	.1625	/ .2225
Eagle	lb.	.2025	/ .2225
National Lead	lb.	.1625	/ .1725

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY AND SUPPLIES FOR SALE (Continued)

FOR SALE—MILL, 16" x 42"; HEAVY-DUTY; 50 H.P./A.C. motor; enclosed reduction drive. MANUFACTURERS SUPPLY CO., 185 Church St., New Haven, Conn.

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WANTED: #1 OR #2 RUBBER EXTRUDER. GIVE DETAILS, price, and condition. Write P. O. Box 63, New Britain, Conn.

RUBBER MANUFACTURER IN EASTERN PENNSYLVANIA would like to purchase a vulcanizer in good operating condition, approximately 40" opening by 30" deep. Address Box No. 816, care of INDIA RUBBER WORLD.

GRANULATED CORK

SOUTHLAND CORK COMPANY

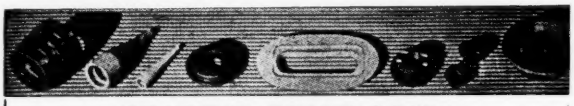
P. O. BOX 868 NORFOLK, VA.

CUSTOM MIXING

We do milling and compounding of all types — blacks or colors — Master Batches —
All mixing done under careful supervision and laboratory control.

PEQUANOC RUBBER CO.

Phone: Butler 9-0400 BUTLER, NEW JERSEY



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THE BARR RUBBER PRODUCTS CO. SANDUSKY OHIO

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THE LANGUAGE OF THE RUBBER INDUSTRY SINCE 1915

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VARIOUS MODELS FOR TESTING THE ENTIRE RANGE

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JAMAICA 2, N. Y.

SINCE 1880 RUBBER & PLASTIC

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"They Last Longer" REG. U. S. PAT. OFF.

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DRESS SHIELD LININGS
BABY PANTS
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RUBBER APRONS
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RUBBER SHEETS
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DOLL PANTS, CAPES, ETC.
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HOWE MACHINERY CO., INC.

30 GREGORY AVENUE PASSAIC, N. J.

Designers and Builders of
"V" BELT MANUFACTURING EQUIPMENT
Cord Latexing, Expanding Mandrels, Automatic Cutting, Skiving, Flipping and Roll Drive Wrapping Machines.
ENGINEERING FACILITIES FOR SPECIAL EQUIPMENT
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"ANNALS OF RUBBER" A Chronological Record of the Important Events in the History of Rubber

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FLEXO JOINTS

THE STANDARD FOR SAFETY

- Proved in years of efficient service, FLEXO JOINTS offer the flexibility of hose — the strength of pipe — the ideal steam connection for presses, tire molds, etc.

Four styles, for standard pipe sizes ¼" to 3".

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FLEXO SUPPLY CO., INC., 4651 Page Blvd., St. Louis 13, Mo. *In Canada:* S. A. ARMSTRONG, LTD. 1400 O'Connor Dr., Toronto 13, Ontario

BELT PRESS WANTED
To Handle belts up to 72" wide

BOX NO. 799, c/o INDIA RUBBER WORLD

U. S. Imports, Exports, and Reexports of Crude and Manufactured Rubber

Exports of Domestic Merchandise

	February, 1951 Quantity	Value
UNMANUFACTURED, Lbs.		
Chicle and chewing gum bases	311,439	$130,635
Balata	1,000	2,755
Synthetic rubbers: GR-S types	9,197	3,250
Neoprene	1,047,973	410,842
Nitrile types	320,846	162,681
Polyisobutylene	6,925	3,023
Other, except butyl and "Thiokol"	3,703	3,250
Reclaimed rubber	3,648,093	351,661
Scrap rubber	3,432,644	175,795
TOTALS	8,781,820	$1,209,892
MANUFACTURED		
Rubber cement ..... *gals.*	87,171	$161,124
Rubberized fabric		
Auto cloth ..... *sq. yds.*	8,381	13,151
Piece goods and hospital sheeting ..... *sq. yds.*	121,308	93,586
Rubber footwear		
Boots ..... *prs.*	5,214	30,063
Shoes ..... *prs.*	3,228	5,230
Rubber-soled canvas shoes ... *prs.*	11,854	28,794
Soles ..... *doz. prs.*	13,569	48,988
Heels ..... *doz. prs.*	68,577	80,924
Soling and toplift sheets ..... *lbs.*	458,198	84,353
Gloves and mittens ..... *doz. prs.*	14,288	53,111
Drug sundries: water bottles and syringes ..... *no.*	11,894	9,584
Other	.....	228,984
And rubberized clothing	.....	118,333
Balloons	.....	22,507
Toys and balls	.....	23,246
Erasers, except pencil ..... *lbs.*	17,854	14,986
Hard rubber goods		
Battery boxes ..... *no.*	32,949	58,253
Other electrical goods ..... *lbs.*	121,317	71,664
Combs, finished ... *doz.*	2,750	3,631
Other	.....	13,008
Tires and casings		
Truck and bus ..... *no.*	53,622	2,612,006
Auto ..... *no.*	25,384	411,573
Aircraft	.....	117,393
Farm tractor, etc. .. *no.*	5,132	164,871
Other off-the-road .. *no.*	4,199	485,596
Bicycle ..... *no.*	8,730	13,560
Motorcycle ..... *no.*	299	2,674
Other ..... *no.*	1,432	40,863
Inner tubes: auto ..... *no.*	14,735	38,885
Truck and bus ..... *no.*	21,013	103,895
Aircraft ..... *no.*	744	5,662
Other ..... *no.*	11,286	36,496
Solid tires: truck and industrial ..... *no.*	1,852	21,578
Tire repair materials		
Camelback ..... *lbs.*	136,352	46,046
Other ..... *lbs.*	204,816	236,360
Rubber and friction tape ..... *lbs.*	44,175	34,224
Belting:		
Auto and home .. *lbs.*	90,259	126,030
Transmission: V-belts *lbs.*	119,475	242,307
Flat belts ..... *lbs.*	29,794	45,164
Other ..... *lbs.*	25,063	35,369
Conveyer and levitator ..... *lbs.*	71,762	51,315
Other ..... *lbs.*	246	366
Hose and tubing .. *lbs.*	410,967	365,133
Packing ..... *lbs.*	187,545	208,455
Mats, flooring, tiling *lbs.*	605,443	165,342
Thread: bare ..... *lbs.*	25,672	52,291
Textile covered .. *lbs.*	13,863	52,758
Gutta percha manufactures ..... *lbs.*	1,510	1,792
Compounded latex and rubber for further manufacture ..... *lbs.*	448,499	195,228
Other natural and synthetic rubber manufactures	.....	656,921
TOTALS	.....	$7,733,797
GRAND TOTALS,	.....	$8,943,689

Reexports of Foreign Merchandise

UNMANUFACTURED, Lbs.		
Crude rubber	1,237,058	$790,245
MANUFACTURED		
Drug sundries, except water bottles and syringes	.....	$920
Rubber toys and balls ...	.....	4,945
Inner tubes, except auto, truck and gus ..... *no.*	51	316
Rubber packing ..... *lbs.*	196	183
Other natural and synthetic rubber manufactures	.....	1,563
TOTALS	247	$7,927
GRAND TOTALS,	.....	$798,172

Imports for Consumption

	February, 1951 Quantity	Value
UNMANUFACTURED, Lbs.		
Crude rubber	110,246,824	$55,013,580
Latex	11,977,937	8,314,086
Crude chicle	602,610	331,751
Guayule	275,200	119,086
Balata	191,523	76,034
Jelutong or Pontianak ...	287,121	214,363
Gutta percha	26,516	11,014
Synthetic rubber	2,838,535	717,084
Reclaimed rubber	224,000	32,805
Scrap rubber	3,792,217	235,205
TOTALS	130,462,483	$65,064,948
MANUFACTURED		
Tires and casings:		
Auto, etc. ..... *no.*	2,892	$78,556
Bicycle ..... *no.*	3,272	5,869
Other ..... *no.*	130	4,350
Inner tubes: auto, etc. *no.*	12,104	36,561
Rubber footwear		
Boots ..... *prs.*	2,718	8,997
Shoes and overshoes *prs.*	1,632	748
Rubber-soled canvas shoes ..... *prs.*	15,224	7,055
Athletic balls: golf .... *no.*	22,500	5,885
Tennis ..... *no.*	23,232	4,477
Other ..... *no.*	338,074	22,499

	February, 1951 Quantity	Value
Rubber toys, except balloons	.....	44,713
Hard rubber goods:		
Combs ..... *no.*	133,278	10,597
Other	.....	45,333
Rubberized printing blankets ..... *lbs.*	3,319	6,890
Rubber and cotton packing ..... *lbs.*	6,502	8,378
Gaskets and valve packing	.....	2,064
Insulators, molded	.....	11,980
Belting ..... *lbs.*	9,028	8,375
Hose and tubing	.....	5,520
Drug sundries	.....	9,339
Nipples and pacifiers ..... *gross*	2,000	2,562
Instruments ..... *doz.*	5,192	9,797
Other rubber products ...	.....	155
Gutta percha manufactures ..... *lbs.*	3,487	3,485
Rubber bands ..... *lbs.*	17,275	11,173
Synthetic rubber products	.....	991
Other soft rubber products	.....	137,057
TOTALS	.....	$493,406
GRAND TOTALS,	.....	$65,558,354

SOURCE: Bureau of Census, United States Department of Commerce, Washington, D. C.

United States Rubber Statistics—January, 1951

(All Figures in Long Tons, Dry Weight)

	New Supply Production	Imports	Total	Distribution Consumption	Exports	Month-End Stocks
Natural rubber, total	0	84,952	84,952	39,346	819	87,000
Latex, total	0	7,502	7,502	5,240	0	6,079
Rubber and latex, total	0	92,454	92,454	44,586	819	93,079
Synthetic rubbers, total	*54,032 †6,920	1,509	62,461	59,584	570	55,453
GR-S types	*47,755 †1,146	1,074	49,975	47,915	87	39,581
Butyl	*6,277	435	6,712	6,406	0	7,640
Neoprene	†4,549	0	4,549	4,120	383	5,351
Nitrile types	†1,225	0	1,225	1,143	100	2,881
Natural rubber and latex, and synthetic rubbers, totals	60,952	93,963	154,915	104,170	1,389	148,532
Reclaimed rubber, total	32,924	120	33,044	32,455	1,336	35,843
GRAND TOTALS	93,867	94,083	187,959	136,625	2,725	184,375

* Government plant production.
† Private plant production.
SOURCE: Industry Operations Bureau, NPA, United States Department of Commerce, Washington, D. C.

Estimated Automotive Pneumatic Casings and Tube Shipments, Production, Inventory, March, February, 1951; First Quarter, 1950

	March, 1951	% of Change from Preceding Month	February, 1951	First Three Months, 1951	First Three Months, 1950
Passenger Casings					
Shipments					
Original equipment	3,124,715		2,601,331	8,318,587	8,119,668
Replacement	2,605,050		2,319,747	7,886,715	7,596,009
Export	53,820		48,348	154,722	130,054
TOTAL	5,783,585	+16.38	4,969,426	16,460,024	15,845,731
Production	5,298,387	+12.79	4,697,767	15,429,463	17,460,397
Inventory end of month	2,055,015	—18.03	2,506,974	2,055,015	10,317,541
Truck and Bus Casings					
Shipments					
Original equipment	494,964		400,301	1,339,590	1,047,321
Replacement	887,602		738,435	2,374,403	1,767,513
Export	68,825		65,931	196,542	212,797
TOTAL	1,451,391	+20.48	1,204,667	3,910,535	3,027,631
Production	1,394,993	+17.29	1,189,378	3,915,010	3,337,490
Inventory end of month	748,599	— 6.43	800,064	748,599	2,003,445
Total Automotive Casings					
Shipments					
Original equipment	3,619,679		3,001,632	9,658,177	9,166,989
Replacement	3,492,652		3,058,182	10,361,118	9,363,522
Export	122,645		114,279	351,264	342,851
TOTAL	7,234,976	+17.18	6,174,093	20,370,559	18,873,362
Production	6,693,380	+13.69	5,887,145	19,344,473	20,797,887
Inventory end of month	2,803,614	—15.22	3,307,038	2,803,614	12,320,986
Passenger and Truck and Bus Tubes					
Shipments					
Original equipment	3,624,165		3,000,163	9,664,618	9,164,864
Replacement	2,896,062		2,842,214	9,223,709	7,493,420
Export	73,131		67,577	210,064	177,399
TOTAL	6,593,358	+11.56	5,909,954	19,098,391	16,835,683
Production	5,827,593	+13.28	5,144,242	16,922,101	17,644,508
Inventory end of month	4,594,538	—10.86	5,154,104	4,594,538	11,465,933

NOTE: Cumulative data on this report include adjustments made in prior months.
SOURCE: The Rubber Manufacturers Association, Inc., New York, N. Y.

INDEX TO ADVERTISERS

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A

A-C Supply Co., The ..... —
Adamson United Co. ..262, 263
Advance Solvents & Chemical Corp. ..... —
Akron Equipment Co., The —
Akron Rubber Machinery Co. 383
Albert, L., & Son 383
Alco Oil & Chemical Corp. 300
Aluminum Flake Co. 370
American Cyanamid Co., Calco Chemical Div. 377
American Polymer Corp. .. —
American Resinous Chemicals Corp. 286
American Zinc Sales Co. .. 363
Ames, B. C., Co. 304

B

Baird Rubber & Trading Co. —
Baker Castor Oil Co., The 261
Barr Rubber Products Co., The 385
Barrett Division, The (Allied Chemical & Dye Corp.) 369
Barry, Lawrence N. 383
Beacon Co., The 274
Berlow and Schlosser Co. 370, 374
Binney & Smith Co. Insert 347, 348
Black Rock Mfg. Co. 302
Bolling, Stewart, & Co., Inc. —
Bonwitt, Eric ..... —
Bridgwater Machine Co., The (Athens Machine Division) 367
Brockton Tool Co. ..... —
Brooklyn Color Works, Inc. 368
Brown Co. ..... —
Burgess Pigment Co. 268

C

Cabot, Godfrey L., Inc. Front Cover, 364
Cambridge Instrument Co., Inc. ..... —
Cameron Machine Co. ..... —
Carey, Philip, Mfg. Co., The 368
Carter Bell Mfg. Co., The 284
Chemical Service Corp. .. 385
Claremont Waste Mfg. Co. 304
CLASSIFIED ADVERTISEMENTS 381, 383, 385
Cleveland Liner & Mfg. Co., The ..... Back Cover
Colledge, E. W., General Sales Agent, Inc. 375
Colonial Insulator Co., The 366
Colonial Rubber Co. 360
Columbian Carbon Co. Insert 347, 348
Manico Color Division .. —
CONSULTANTS & ENGINEERS 374
Curran & Barry 379

D

Dewey & Almy Chemical Co. 368
Diamond Alkali Co.. 272
Diamond Metal Products Co. 379
Dow Corning Corp. 365
du Pont de Nemours, E. I., & Co., Inc.:
Grasselli Chemicals Dept. 292
Organic Chemicals Dept. —
Rubber Chemicals Div. Inside Front Cover

E

Eagle-Picher Co., The 304
Emery Industries, Inc. ... —
Erie Engine & Mfg. Co. .. 258
Erie Foundry Co. 305

F

Farrel-Birmingham Co., Inc. 275
Ferry Machine Co. 379
Fidelity Machine Co., Inc. —
Flexo Supply Co., The .. 385
Flintkote Co., The ..... —
Foxboro Co., The 362
French Oil Mill Machinery Co., The ..... —

G

Gammeter, W. F., Co., The 374
General Atlas Carbon Co., The 273
General Electric Co. (Chemical Dept.) ..... —
General Latex & Chemical Corp. 304
General Tire & Rubber Co., The 302
Genseke Brothers 299
Gidley Laboratories, Inc. .. —
Giffels & Vallet, Inc. 277
Glidden Co., The (Chemical & Pigment Co. Division) 293
Goodrich, B. F., Chemical Co. (Chemicals) ..... —
Goodrich, B. F., Chemical Co. (Hycar) 255
Goodyear Tire & Rubber Co., Inc., The, (Chemical Division) 259, 285

H

Hadley Bros.—Uhl Co. ... 284
Hall, C. P., Co., The 281
Hardesty Chemical Co., Inc —
Hardman, H. V., Co., Inc. 366
Harwick Standard Chemical Co. 291
Heveatex Corp. 290
Hoggson & Pettis Mfg. Co., The ..... —
Holliston Mills, Inc., The .. 294
Home Rubber Co. 302
Howe Machinery Co., Inc. 385
Huber, J. M., Corp. 306

I

Independent Die & Supply Co. 370
Indoil Chemical Co. 289
Industrial Ovens, Inc. .... —
Institution of the Rubber Industry ..... —
Interstate Welding Service —

J

Johnson Corp., The ..... —

K

Koppers Co., Inc. 296

L

Littlejohn & Co., Inc. .... —

M

Marbon Corp. ..... —
Marine Magnesium Products Division of Merck & Co., Inc. ..... —
Martin Rubber Co. 381
Monsanto Chemical Co. 371
Morris, T. W., Trimming Machines 290
Muehlstein, H., & Co., Inc. 359

N

National Erie Corp. 288
National Lead Co. ..... —
National Rubber Machinery Co. 266
National Sherardizing & Machine Co., The 383
National-Standard Co. 298
Naugatuck Chemical, Division of U. S. Rubber Co. 257, 271, 297
Neville Co., The 303
New Jersey Zinc Co., The 264

O

Osborn Manufacturing Co., The 287

P

Pan American Chemicals, Division Pan American Refining Corp. 294
Pennsylvania Industrial Chemical Corp. ..... —
Pequanoc Rubber Co. 385
Phillips Chemical Co. 256, 360, 368, 375
Pike, S. J., & Co., Inc. .. 288
Pittsburgh Coke & Chemical Co. ..... —
Polymel Corp., The 270

R

Rand Rubber Co. 385
Rare Metal Products Co. .. 379
Richardson, Sid, Carbon Co. 388
Royle, John & Sons 300
Rubber Corp. of America (Latex Division) 360

S

St. Joseph Lead Co. 282
Schulman, A., Inc. Inside Back Cover
Scott Testers, Inc. 374
Sharples Chemicals Inc. .. —
Shaw, Francis, & Co., Ltd. 278
Shell Oil Co. ..... —
Shore Instrument & Manufacturing Co., Inc., The 385
Simplex Cloth Cutting Machine Co., Inc. ..... —
Skelly Oil Co. ..... —
Snell, Foster D., Inc. 374
Socony-Vacuum Oil Co., Inc. 301
Southeastern Clay Co. .... —
Southern Clays, Inc. 276
Southland Cork Co. 385
Spadone Machine Co., Inc. —
Spencer Products Co., The 374
Stamford Rubber Supply Co., The 286
Standard Machinery Co., The 292
Stanley Chemical Co. .... —
Stauffer Chemical Co. .... —
Sun Oil Co. ..... —

T

Tanney-Costello, Inc. ..... —
Taylor Instrument Cos. ... —
Testworth Laboratories, Inc. 375
Textile Proofers, Inc. 364
Timken Roller Bearing Co., The 357
Titanium Pigment Corp. .. 260
Tumpeer Chemical Co. 373
Turner Halsey Co. 269

U

United Carbon Co., Inc. Insert 279, 280
United Engineering & Foundry Co. 283
United Rubber Machinery Exchange 383
U. S. Rubber Reclaiming Co., Inc. 267

V

Vanderbilt, R. T., Co., Inc. 308

W

Wade, Levi C., Co., ... 370
Watson-Standard Co. 370
White, J. J., Products Co. . 296
Whittaker, Clark & Daniels, Inc. ..... —
Williams, C. K., & Co. .. 372
Wilson, Charles T., Co., Inc. 373
Witco Chemical Co. 361
Wood, R. D., Co. 295
Wyandotte Chemicals Corp. 265

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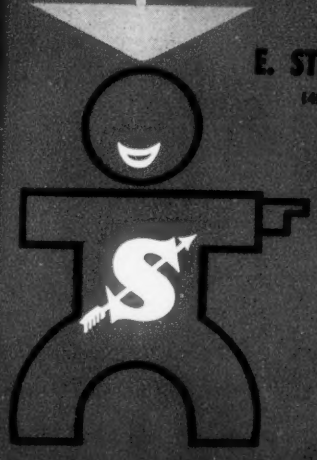

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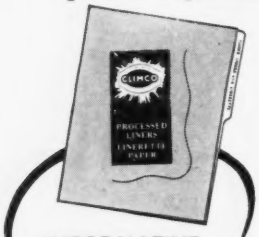

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